ELEMENTOS BIBLIOGRAFICOS

AUTOR (ES): Eddleman, B.R.; Meyer, N.L.
TITULO: Minimum land requirements for specified income levels, Lower Sinu River Valley of Colombia

September 1971

Ag. Econ. Report 30

Minimum Land Requirements for Specified Income Levels, Lower Sinu River Valley of Colombia

Department of Agricultural Economics
Center for Tropical Agriculture
Institute of Food and Agricultural Sciences
University of Florida, Gainesville

B. R. Eddleman
Neil L. Meyer

MINIMUM LAND REQUIREMENTS FOR SPECIFIED INCOME LEVELS, LOWER SINU RIVER VALLEY OF COLOMBIA

B. R. Eddleman* and Neil L. Meyer**

INTRODUCTION

Policy makers concerned with planning for agricultura1 development continually need information that can be useful in planning farm size and in evaluating returns from alternative enterprise and production practices on farms. They must frequently re-evaluate their plans when technologic and economic conditions change. This publication provides information that can be useful in evaluating profitability of farm organizations and changes in these farm organizations in the lower Sinu River Valley of Colombia. Although not directly applicable to all farms in the area, the information on enterprise budgets contained in the appendix is presented in such a manner that adjustments in input-output data (yields, prices, etc.) can readily be made and the estimates applied to a specific situation.

The purpose of this study is to ascertain for the Cordoba II Project in the lower Sinu River Valley area the minimum land requirements and optima1 enterprise combinations necessary to produce a net farm income of 15,000 pesos and 25,000 pesos with specified yields, land quality, prices

*Associate Professor of Agricultura1 Ecnnomics and Associate Agricultural Economist, Florida Agricultura1 Experiment Stations, University of Florida.

**Formerly, Research Assistant, Department of Agricultural Economics, University of Florida.

of cotton and rice, and costs of capital and hired labor, when land prices and operator equity are at a specified level; and to estimate the total number of farms that the project area could support if all farms were developed as units with the necessary minimum size.

THE STUDY AREA

The Department of Cordoba is located in the northwestern part of Colombia and is part of the Caribbean Coastal Plain. The northwestem part of the Department constitutes the lower Sinu River Valley flood plain.

The Department is bordered on the west by the Gulf of Turbo, on the southwest by the Abide Ridge, on the east by the Ayapel Ridge, and on the north by the Caribbean Sea. The San Jeronimo Ridge divides the Department with the San Jorge River Valley to the east and the Sinu River Valley to the west.

The lower Sinu Valley, where the Cordoba IL project is located, is between the Abide and San Jeronimo Ridges. The Valley has a width of approximately 18 kilometers and has an elevation of about 15 meters above sea leve1 [1, p. 3]. It ís a typical alluvial plain, slightly sloping away from the Sinu River toward the east and toward the Betanci Ravine. Before drainage work began, at least 60 percent of the aren flooded at least once a year [1, p. 1]. This flooding brought accompanying sedimentation which formed high fertility soils appropriate for various tropical cultures. These lands have produced the lush green forage which, in turn, provides a basis for the prominent livestock industry of the area.

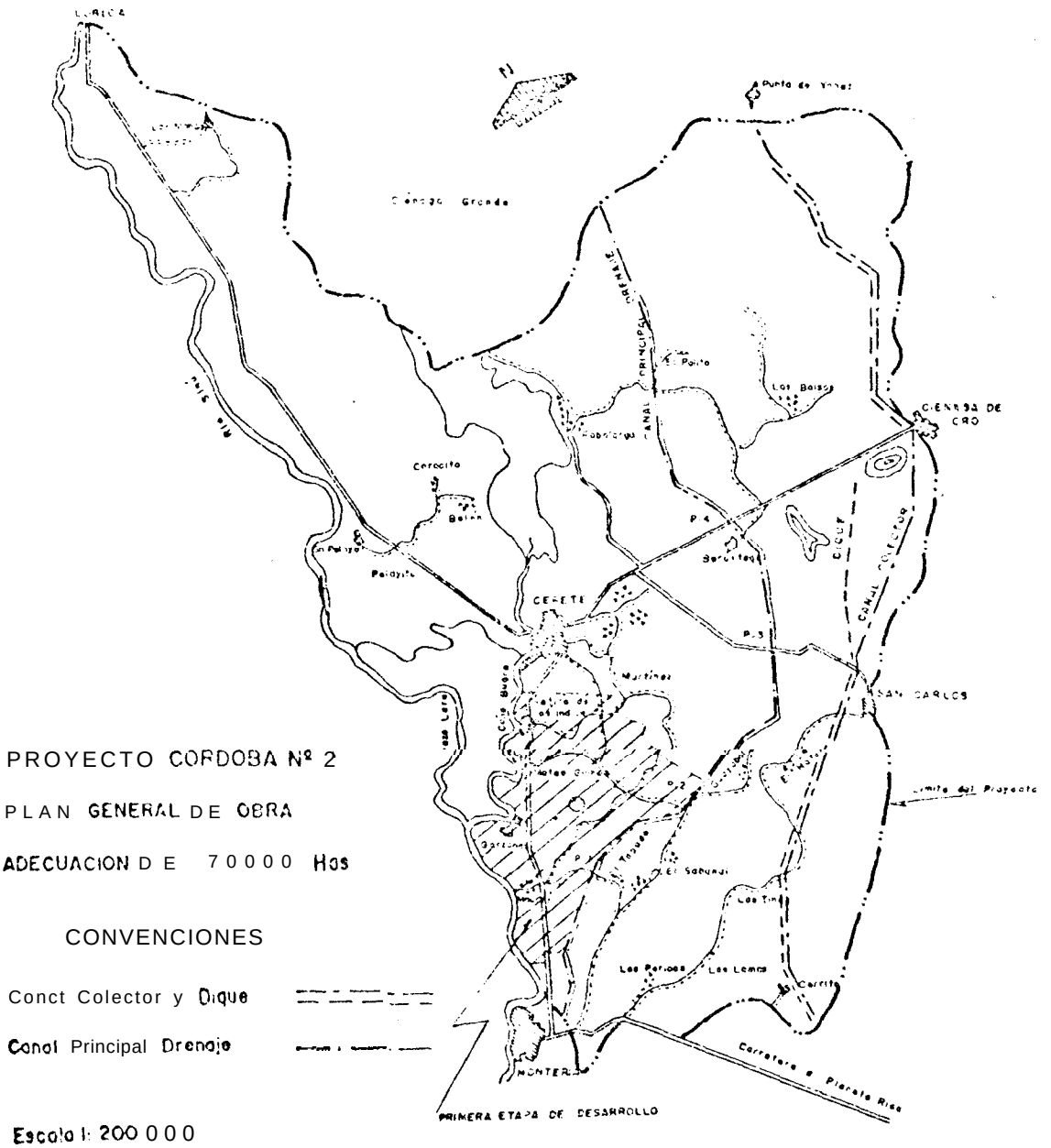
The valley is level but, because of sedimentation along the river bank, there is a very gentle slope away from the river. This is the reason a large part of the valley is flooded during the wet (winter)

season. The aren has a large variety of poorly drained soils located over fine or medium grain sand. The surface soils consist of fine silt or clay, especially in the zones subject to flooding. The land in the project area has less than a 3 percent slope [2, p. 3].

The total project area of 70,000 hectares is bounded on the west by the Sinu River, on the south by Monteria, on the southeast and east by the San Jeronimo collector canal, and on the north by the Cienaga Grande (Figure 1). This study refers to the drainage aspects of the 7,000 hectares that comprise the first phase; it also has wider implications for the total project and other similar areas.

The soils in the project area have textures that vary generally from medium-light to heavy, with medium subsoils occasionally interspersed with total horizons of heavy soils. The permeability is moderately rapid in the light and medium textured soils to very slow in the heavy textured soils. The average pH is slightly above 7.0 with the exchange capacity varying from medium to high, depending on the clay content of the soil.

The region alternates between two contrasting rainfall patterns. In the dry months, December through March, rainfall ranges from 10.4 mm. to 36.9 mm. per month, with an average of 23.0 mm. During the high rainfall period, April through November, the monthly precipitation varies from 91.8 mm. to 169.1 mm. per month, with an average of 124.3 mm. The annual average rainfall is 1201.7 mm., with a range from 867.5 mm. to 1620.5 mm., based on 13 years of records from the Turipana Experiment Station. A study of the rainfall pattern affords a clearer picture of the water distribution problem. Because ít is a tropical area, great amounts of rainfall are not uncommon; in a single month, as much as 350 mm. has been known



Source : INCORA (Memo) , Monteria.

Figure 1.--Project map of Cordoba II

to fall, which is over 25 percent of the average annual rainfall [1, p. 5].

The area has been mainly a livestock producing area because of the low elevatíon, Long wet season, and the periodic flooding of the Valley. In the flood free and the newly drained areas, many crops are presently grown; more significant, however, is the fact that more crops can be grown commercially.

The annual average temperature of the lower Sinu Valley is 27.5" C., with an average maximum of 34.0" C. and an average minimum of 22.0" C. [3, p. 351. Throughout the wet (winter) season, the humidity is in excess of 80 percent. Severa1 months during the dry (summer) period, winds blow from the northeast causing the temperature and humidity to drop slightly. Normally in this area there is a brief secondary dry season in July or August called the Veranillo de San Juan, permitting harvesting and replanting when a double cropping system is employed.

METHOD OF ANALYSIS

In this analysis net farm income is defined as gross farm income less costs of all inputsexcept owned land, operator and family labor, and management. The income may represent a return to operator and family labor only, or to labor plus other owned resources. The only restriction was that the nonlabor-owned resource returns must come from the farm business. The hectares required to produce a specified net farm income is dependent upon the quality of the land, the cost of inputs, prices obtained for commodities sold, the weather, and quality oí manegement. These factors are taken into account , either through enterprise budgets or throug'h programming procedures.

Crop enterprises considered ín the analysis were cotton, rice, corn, grain sorghum, soybeans, and sesame. Forage enterprises were Para pasture

production under traditional, improved and most modern production practices and the livestock enterprises were beef cattle with cow-calf production and beef fattening activities. Limited information on production practices for other Livestock and poultry precluded their consideration as possibie enterprises.

Enterprise budgets and equipment needs were developed by the authors in cooperation with personnel of the Turipana Agricultura1 Experiment Station of the Tnstituto Colombiano Agropecuario (ICA) and agricultura1 technicians of the Instituto Colombiano de la Reforma Agraria (INCORA). The leve1 of technology assumed in the development of the budgets is usually referred to as "recommended practices" under conditions of labor intensive and mechanized production practices (Appendix Tables 1 through 12). Soil type was divided into four productivity classes; the criteria for classification including texture and interna1 drainage, but emphasizing economic differences (Appendix Table 13). Yield levels for the various crop and pasture alternatives on each land class were specifically related to the productive capacities of particular soils. A representative hectare of land was assumed to be a variable resource that could be added in completely divisible and homogenous units. The quality of Land was assumed to be average and was defined as a representative hectare composed of 54 percent Class I, 7 percent Class II, 25 percent Class III, and 14 percent Class IV soil.

Land va lues and est imated cost per hectare of owning land were assumed to vary with the percentage of each productivity class of soil comprising the representative hectare of average quality land (Appendix Table 14).

Under certain conditions yields of crop and livest ock enterprises were assumed to vary and shif t the production function. Different yield

levels may be attributed to management, technology, weather, or other causes. The yield ievels used were defined as follows:

(aj Average yields are those of all crops, forages or livestock expected for the area based on current or improved production practices recommended by the ICA Turipana Experiment Station on land having adequate surface water drainage facilities.

(b) High yields are those for all crops, forages or livestock that are 10 percent above average expected yields for the area and are based on potentially new production practices for the arta, and/or the best weather (rainfall and drainage) conditions.

(c) Low yields are those for all crops, forages or livestock that are 10 percent below average expected yields for the area.

It was estimated from an area survey that each farm operator could work up to 282 days each year (Appendix Table 15). Family labor other than the operator's could provide an additional 294 man days each year. The available annual labor was divided into time periods reflecting the seasonality of farm labor requirements. It was assumed that because of the high rate of unemployment (currently about 30 percent) and the under-employment in the area, seasonal hired labor would be available as needed.

The major product and factor prices used were approxi.mate current prices received and paid in the area and are not to be interpreted as predictions or forecasts of prospective prices for any future period. Prices received for crops are 2-year averages based on actual prices received by farmers in the area during 1968-69. Livestock prices are 2-year average:; based on the fat cattle market in Medellin for 1468-69. The local feeder cattle price was obtained from interviews with area producers and livestock specialists. Prices paid were obtained from local suppliers and are based on cash sales.

Capital was not considered a limiting factor since the loan limits set by INCORA exceeded the capital requirements for the programmed farm situations. As l ong as returns to capital for the firm were greater than

or equal to the cost, capital could be borrowed in variable units. The basic capital charges were 9 percent annually for crop and livestock operating capital, ll percent for farm machinery and equipment capital, and 4 percent for land capital. Operators entering INCORA programs generally have no capital. In these zero equity situations, they must pay full interest charges for all operating and land capital. Therefore, in the analysis, the return to land was considered rent to be paid to INCORA.

Linear programming procedures were used to calculate the minimum land requirements for a net farm income of 15,000 pesos and 25,000 pesos for a zero equity situation, three yield levels and an average land quality situation. Additionally, for average yields on average quality land four levels of interest charges on capital, four hired labor prices, four levels of cotton prices, and four levels of prices for rice were programmed to show the effects of changes in these important variables. For each programmed situation the total size of the unit necessary to fully utilize a tractor and machinery complement and the number of individual families making up the commercial unit were determined.

MINIMUM LAND REQUIREMENTS

The amount of land required to produce a specified farm income varies with changes in the yield level, prices of inputs and outputs, and the combinations and type of enterprises considered.

Effects of Changes in Yields

Minimum land requirements and optima1 farm organizations were developed with yields held at three different levels and prices for production factors and products held at their average expected levels for each of the two different net farm income situations. The results are shown in

Tables 1 to 3, and are based upon the assumptions that the operator has no equity in the land and that he is required to pay an annual land cost of 755 pesos per hectare.

With average quality land and high crop and livestock yields, 3.1 hectares of open land are needed to produce a net farm income of 15,000 pesos and 5.6 hectares are needed to produce a net farm income of 25,000 pesos (Table 1). When yields are 10 percent below the average expected leve1 (low yields), 5.3 hectares of open land are required to net 15,000 pesos of farm income and 9.9 hectares are required to produce 25,000 pesos of net farm income (Table 3). Thus with average quality land, a 10 percent increase in yields decreases the number of hectares required for both specified net farm income levels by about 20 percent. A 10 percent decrease in yields increases the land requirements by about 36 percent for a 15,000 peso income and by about 40 percent for a 25,000 peso income.

Partially mechanized cotton carne into the optima1 farm organizations for each of the three yield levels and both specified net farm income levels. Other important crop enterprises were mechanized rice and partially mechanized rice. A small unit of the cow-calf enterprise entered each of the optima1 farm organizations as well as a few purchased fattening bulls. The number of fattening animals varied from 1.5 bulls with high yields on a family farm unit producing 15,000 pesos of net income to 3.4 bulls with average and low yield levels on a family unit providing 25,000 pesos of net farm income.

The capital investment required for these farm organizations varies from a low of about 54,400 pesos to just over 92,500 pesos on the farms producing 15,000 pesos of net income. On farms producing 25,000 pesos of net income, total capital investment varies from 97,900 pesos to 172,500

Table 1.--Minimum land required to produce a net farm income of 15,000 pesos and 25,000 pesos with high yields on average quality land, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	15,000 peso net income		25,000 peso net income	
	Family unit	Commercial (19 families)	Family unit	Commercial (10 families)
	Hectares			
Land use				
Cotton (partially mechanized)	1.9	36.1	3.4	34.0
Rice (mechanized)	0	0	1.0	10.0
Rice (partially mechanized)	.8	15.2	.4	4.0
Para pasture (best managed)	.4	7.6	.8	8.0
Total land	3.1	58.9	5.6	56.0
	Number			
Livestock				
Beef cows (best managed)	.3	6.0	.5	5.0
Purchased fattening bulls	1.5	28.0	2.7	27.0
	Man days			
Labor				
Operator and family	263.2	5,001	286.0	2,860
Hired	0	0	57.3	573
Total labor	263.2	5,001	343.3	3,433
	Pesos			
Capital investment				
Land	52,235	992,465	94,360	943,600
Other	2,206	41,914	3,543	35,430
Total investment	54,441	1,034,379	97,903	979,030
Total operating capital	14,703	279,357	28,076	280,760
Total income	29,370	558,030	52,596	525,960
Crop operating expenses	8,102	153,938	15,392	153,920
Pasture and beef operating expenses	3,291	62,529	5,894	58,940
Annual interest on operating cap.	636	12,084	1,222	12,220
Hired labor expenses	0	0	860	8,600
Returns to land	2,341	44,479	4,228	42,280
	Hours			
Power and machinery requirements				
Period 1 (Jan.-Feb.)	4.3	81	7.6	76
Period II (March-June)	1.9	36	3.4	34
Period III (July-Sept.)	19.2	365	36.2	362
Period IV (Oct.-Dec.)	3.5	66	5.4	54

Table 2.--Minimum land required to produce a net farm income of 15,000 pesos and 25,000 pesos with average yields on average quality land, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	15,000 peso net income		25,000 peso net income	
	Family unit	Commercial (15 families)	Family unit	Commercial (7 families)
	Hectares			
Land use				
Cotton (partially mechanized)	2.4	36.0	4.3	30.1
Rice (mechanized)	.3	4.5	1.7	ll.9
Rice (partially mechanized)	.7	10.5	.1	.7
Para pasture (best managed)	.5	7.5	1.0	7.0
Total land	3.9	58.5	7.1	49.7
	Number			
Livestock				
Beef cows (best managed)	.4	6.0	.7	5.0
Purchased fattening bulls	1.9	28.0	3.4	24.0
	Man days			
Labor				
Operator and family	282.5	4,238	289.0	2,023
Hired	8.7	130	102.0	714
Total labor	291.2	4,368	391.0	2,737
	Pesos			
Capital investment				
Land	65,715	985,725	119,635	837,445
Other	2,891	43,365	5,157	36,099
Total investment	68,606	1,029,090	124,792	873,544
Total operating capital	18,778	281,685	36,611	256,277
Total income	33,389	500,835	61,057	427,349
Crop operating expenses	10,393	155,895	19,981	139,867
Pasture and beef operating expenses	4,116	61,740	7,527	52,689
Annual interest on operating cap.	806	12,090	1,659	11,613
Hired labor expenses	130	1,950	1,530	10,710
Returns to land	2,944	44,160	5,360	37,520
	Hours			
Power and machinery requirements				
Period I (Jan.-Feb.)	5.4	81	9.7	68
Period II (March-June)	2.4	36	4.3	30
Period III (July-Sept.)	24.8	372	46.8	328
Period IV (Oct.-Dec.)	4.2	63	6.6	46

Table 3.--Minimum land required to produce a netfarm income of 15,000 pesos and 25,000 pesos with low yields on average quality land, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	15,000 peso net income		25,000 peso net income	
	Family unit	Commercial (10 families)	Family unit	Commercial (7 families)
	Hectares			
Land use				
Cotton (partially mechanized)	3.2	32.0	6.0	42.0
Rice (mechanized)	.9	9.0	2.5	17.5
Rice (partially mechanized)	.4	4.0	0	0
Para pasture (improved manage.)	.8	8.0	1.4	9.8
Total land	5.3	53.0	9.9	69.3
	Number			
Livestock				
Beef cows (best managed)	.4	4.0	.7	5.0
Purchased fattening bulls	1.8	18.0	3.4	24.0
	Man days			
Labor				
Operator and family	285.0	2,850	298.8	2,092
Hired	48.1	481	225.3	1,577
Total	333.1	3,331	524.1	3,669
	Pesos			
Capital investment				
Land	89,305	893,050	166,815	1,167,705
Other	3,220	32,200	5,724	40,068
Total investment	92,525	925,250	172,539	1,207,773
Total operating capital	23,538	235,380	46,495	325,465
Total income	39,200	392,000	72,938	510,566
Crop operating expenses	14,562	145,620	27,756	194,292
Pasture and beef operating expenses	3,834	38,340	7,134	49,938
Annual interest on operating cap.	1,080	10,800	2,193	15,351
Hired labor expenses	722	7,220	3,380	23,660
Returns to land	4,002	40,020	7,475	52,325
	Hours			
Power and machinery requirements				
Period 1 (Jan.-Feb.)	7.2	72	13.5	94
Period II (March-June)	3.2	32	6.0	42
Period III (July-Sept.)	33.9	339	58.0	406
Period IV (Oct.-Dec.)	5.9	59	16.6	116

pesos. Capital investment varies inversely with the yields of crop and livestock enterprises.

The INCORA Cordoba II Project is structured and administered so that a number of farm operators share ownership and use of a tractor and machinery complement. The land is farmed as one single commercial unit among these operators with them and their families providing a common labor force on the cooperative farm.

The number of farm operators and families that would fully utilize a tractor and machinery complement during the period of largest machinery requirements was determined and used to compute the land, enterprise, labor, capital and other informational components of the commercial cooperative farm.

In every situation the restrictive period for power and machinery was Period III (the restrictive month was August). The number of operators comprising a commercial cooperative farm varies from 19 with high yields to 10 with low yields for a unit that produces 15,000 pesos of net income for each operator and his family. For a 25,000 peso net farm income per operator, the number of operators varies from 10 with high yields to 7 with average and low yields.

For each of the yield situations, the hectares of either mechanized rice or partially mechanized rice and the number of cow-calf units were very small, even for the commercial cooperative unit. Additional farm organizations were programmed that considered only purchased fattening bulls as the livestock enterprise and either mechanized rice or partialiy mechanized rice enterprises. These farm organizations were programmed only for the average expected yield level for crops and livestock.

With partially mechanized rice only very small changes occurred in

the size of the enterprises for both the 15,000 peso and 25,000 peso net farm income levels (Table 4). A small increase Sn the hectares of cotton and Para pasture occured for both income levels and a .1 hectare increase in total rice production occurred on the farm producing 25,000 pesos of net income. Total labor requirements were increased considerably. This was due to the large labor requirement during the month of December to harvest rice. Only small increases occurred in the investment capital requirements, with the largest increase (about 8,800 pesos) being on the farm producing 25,000 pesos of net income.

When the rice enterprise was restricted to mechanized production the optima1 farm organization was almost identical for the solution for partially mechanized rice on the 15,000 peso net income unit (Table 5). However, the number of operators comprising the commercial cooperative farm decreased from 15 to 13 when mechanized rice was required. For the 25,000 peso net farm income, there was a small reduction in size of all the enterprises when rice was restricted to mechanized production as compared to partially mechanized production. These results indicate that rather small changes may be expected to occur in the optima1 farm organizations for the various mixes of Livestock and rice enterprises on these farms.

Implication of Yields for Farm Size Planning Decisions

Variable yield results can provide information on environments characterized by risk and uncertainty rather than by perfect knowledge. The results can also provide information for groups of producers outside the project area or for producers whose management abilities are above or below the average assumed in this study.

It was assumed in all programmed results that the amounts and prices

Table 4.--Minimum land required to produce a net farm income of 15,000 pesos and 25,000 pesos with average yields on average quality land, restricted to purchased fattening bulls and partially mechanized rice, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	15,000 peso net income		25,000 peso net income	
	Family unit	Commercial (15 families)	Family unit	Commercial (7 families)
		Hectares		
Land use				
Cotton (partially mechanized)	2.5	37.5	4.8	33.6
Rice (partially mechanized)	1.0	15.0	1.9	13.3
Para pasture (improved management	.6	9.0	1.1	7.7
Total land	4.1	61.5	7.8	54.6
		Number		
Land				
Purchased fattening bulls	2.3	34.0	4.4	31.0
		Man days		
Labor				
Operator and family	287.0	4,305	313.9	2,197
Hired	53.5	802	342.4	2,397
Total labor	340.5	5,107	656.3	4,594
		Pesos		
Capital investment				
Land	69,085	1,036,275	131,430	920,010
Other	839	12,585	1,595	11,165
Total investment	69,924	1,048,860	133,025	931,175
Total operating capital	18,165	272,475	38,603	270,221
Total income	34,963	524,445	67,392	471,744
Crop operating expenses	10,584	158,760	20,400	142,800
Pasture and livestock operating expenses	4,595	68,925	8,856	61,992
Annual interest on operating cap.	885	13,275	2,111	14,777
Hired labor expenses	803	12,045	5,136	35,952
Returns to land	3,096	46,440	5,889	41,223
		Hours		
Power and machinery requirements				
Peri.od 1 (Jan.-Feb.)	5.6	84	10.8	76
Period II (March-June)	2.5	38	4.8	34
Period III (July-Sept.)	25.0	375	47.9	335
Period IV (Oct.-Dec.)	4.5	68	8.6	60

Table 5.--Minimum land required to produce a net farm income of 15,000 pesos and 25,000 pesos with average yields on average quality land, restricted to purchased fattening bulle and mechanized rice, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	15,000 peso net income		25,000 peso net income	
	Family unit	Commercial (13 families)	Family unit	Commercial (7 families)
		Hectares		
Land use				
Cotton (partially mechanized)	2.5	32.5	4.4	30.8
Rice (mechanized)	1.0	13.0	1.8	12.6
Para pasture (improved manage.)	.6	7.8	1.0	7.0
Total land	4.1	53.3	7.2	50.4
		Number		
Livestock				
Purchased fattening bulls	2.3	30.0	4.1	29.0
		Man days		
Labor				
Operator and family	205.1	2,666	281.1	1.96%
Hired	14.7	191	104.0	72%
Total labor	219.8	2,857	385.1	2,696
		Pesos		
Capital investment				
Land	69,085	898,105	121,320	849,240
Other	853	11,089	1,474	10,318
Total investment	69,938	909,194	122,794	859,558
Total operating capital	18,766	243,958	34,049	238,343
Total income	35,579	462,527	62,331	436,317
Crop operating expenses	11,644	151,372	20,399	142,793
Pasture and beef operating expenses	4,595	59,735	8,191	57,337
Annual interest on operating cap.	1,023	13,299	1,746	12,222
Hired labor expenses	221	2,873	1,559	10,913
Returns to land	3,096	40,248	5,436	38,052
		Hours		
Power and machinery requirements				
Period 1 (Jan.-Feb.)	5.6	73	9.9	69
Period II (March-June)	2.5	33	4.4	31
Period III (July-Sept.)	27.0	351	47.8	335
Period IV (Oct.-Dec.)	3.8	49	6.7	47

of all inputs and outputs were known with certainty. Use of high, average, and low crop and livestock yields provided a method for obtaining information on a range of possible outcomes through programming. The effect on operator incomes would be the same if any of the assumed constants in the programming analysis were allowed to vary.

Theoretically, uncertainty implies additional costs or lost revenue due to improperly timed harvest, pasture not grazed, inopportune livestock sales, or reduced input levels with resulting lower outputs than under conditions of certainty. No attempt has been made to determine the range or standard deviation of net income variability encountered by producers. Assuming the probability is low that net income will vary more than the variations associated with yield changes of plus and minus 10 percent, the results will be useful for evaluating management decisions under uncertainty. If the probability is great that net income will vary more than that associated with these yields, then these results are of limited worth in evaluating uncertainty.

For some of the family farm units, uncertainty is closely associated with survival. If a normal distribution for programmed incomes is assumed, 50 percent of the time incomes will be less than specified. If family farm unit survival requires a minimum income 75 percent of the time, a larger size unit than indicated by average yields is required. For example, with low yields on average quality land a family farm unit required 5.3 hectares for a 15,000 peso net income. However, with average yields on average quality land, only 3.9 hectares were required. A farmer receiving low yields on average quality land for a unit programmed with average yield would have only 73.5 percent of the land necessary to attain an income of 15,000 pesos annually.

The programmed results shown in Figure 2 indicate a range of farm incomes for various farm sizes with three different yield levels. The range of incomes increases as farm size increases. For example, a three-hectare farm has an income of about 8,500 pesos for low yields and about 14,750 pesos for high yields, or a range of 6,250 pesos. A 50 percent increase in farm size to 4.5 hectares would provide an income of about 12,750 pesos for low yields and about 20,750 pesos for high yields, or an 8,000 peso range. The expected results of larger family farm units are: (a) increased expected mean incomes, and (b) increased range of expected incomes.

Environments above or below average are shown by the fact that individual operators have different average returns from the same set of production conditions. This difference is often attributed to differences in production techniques, managerial skills, or both. Therefore, average for some farm operators may be represented by high yields in this study, whereas average for others may be represented by low yields.

If the programmed results cover the practica1 range of variability in management skill, the information presented in Figure 2 may show the probable gains or losses from different levels of management employed on various farm family unit sizes. For the next 15 years, farm sizes in the Cordoba II Project area will be fixed. Any increases in farm family income will come from increased productivity or efficiency.

Results of programming high, average, and low yields indicated that when labor was fixed to the family production unit, increases in farm size increased utilization of family labor, increased family income, and also provided enlarged returns to superior management skills.

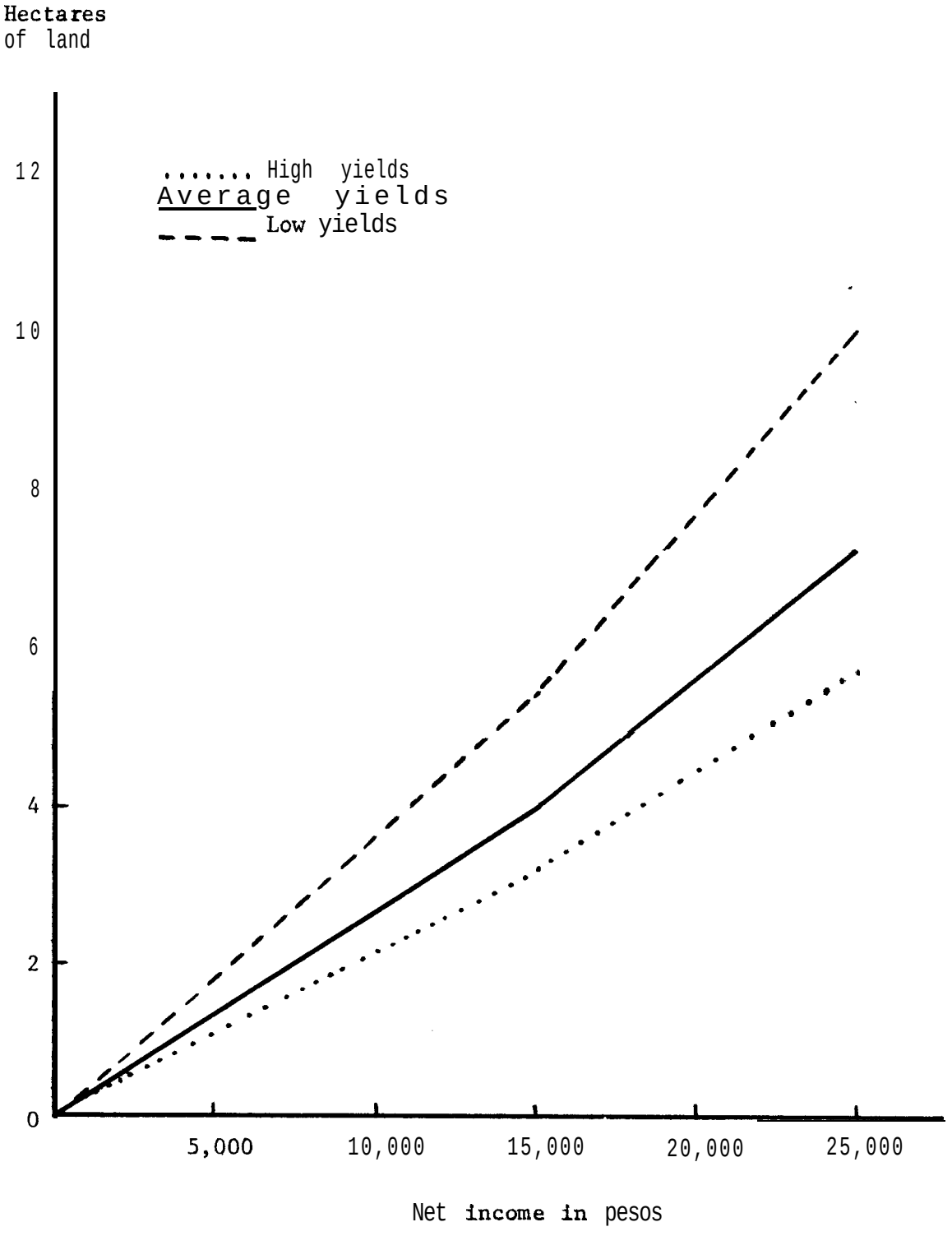


Figure 2.--Hectares of land required to produce specified net incomes with high, average and low yields on average quality land.

Area Implications of Yield Variations

The economy of an area can be greatly affected by a 10 percent increase or decrease in area yields. Increasing area yields by 10 percent can increase area farm income by approximately 7 million pesos (Table 6). Total economic activity in the area would be increased by 7 million pesos times the multiplier effect. It is apparent that non-farm businesses as well as farmers can benefit from improved agricultural technology, such as new crop varieties, water management, chemical inputs, and improved management systems that increase yields. The reverse is true if these improved technologies are not adopted in the study area and if other areas of Colombia adopt output increasing technologies which cause prices to decline because of increased supply.

Net returns are practically a linear function of the number of hectares in the farm unit. The increase or decrease in area income caused by how farms are organized is relatively small compared to the increase or reduction in income caused by higher or lower yields.

Though the specific income leve1 and activity mix selected for each farm unit does not materially affect total farm income of the area, it does have a direct effect on the number of farm family units the area can support. The number of farm families and their income levels are important for decisions concerning schools, social institutions, markets and communications.

The number of cooperative farms, family units and the area income for alternative levels of farm family income are shown in Table 6. High yield levels increase both area farm income and the number of family units that can be established in the project area by an average of about 21 and 26 percent, respectively, for both income levels. The

Table 6.--Effect of high, average, and low yields on numbers of farms and area net farm income for specified income levels, Cordoba II Project, Lower Sinu River Valley of Colombia

Yields	Item	Unit	Income level	
			15,000 pesos	25,000 pesos
High	Area cooperative farms[a]	Number	119	125
	Change[b]	Percent	0	-11.3
	Family units[a]	Number	2,258	1,250
	Change[b]	Percent	25.9	26.9
	Area income[c]	Pesos[d]	40,572	38,063
	Change[e]	Percent	20.6	20.7
Average	Area cooperative fanns	Number	119	141
	Family units	Number	1,794	985
	Area income	Pesos	33,638	31,539
Low	Area cooperative farms	Number	132	101
	Change	Percent	10.9	-28.4
	Family units	Number	1,320	707
	Change	Percent	-26.4	-28.2
	Area income	Pesos	26,508	24,400
	Change	Percent	-21.2	-22.6

[a]The number of cooperative farms and family units is calculated from the estimated 7,000 hectares in the study area and the minimum land requirements given in tables 1 through 3.

[b]The percent change is based on the number of cooperative farms and family units the area can support at average yields.

[c]Area income used here includes only returns to operator and family labor, a 4 percent return on land capital, a 9 percent return on crops and livestock operating capital, ll percent return on machinery capital, and real estate taxes.

[d]These units are in thousands.

[e]The percent change is based on the area income at average yields.

number of area cooperative farms remains unchanged at the lower income leve1 and declines by about 11 percent at the higher income level. This decline is due to the increase in the number of families that comprise the commercial unit and the associated increase ín the hectares of land in the commercial unit.

The number of farm families and the per farm income are also important for evaluating future levels of demand for inputs and consumer goods within the area. If development results ín larger family units with a larger per farm income, the aggregate demand schedule for products ín the area will differ from that under a situation of lower incomes per farm and more family units. The actual aggregate demand will depend on individual tastes and preferences and the income elasticity of demand for a particular good.

Effects of Increases in Interest Rates

The optimum organizations for a 15,000 and a 25,000 peso income leve1 and four levels of interest rates are considered ín this section. Higher interest rates increased the minimum farm size, decreased the total operating capital used and slightly increased the total labor required. Although the kinds of crops and livestock produced did not change, there were shifts to more labor intensive methods of producing these activities. Because of increased emphasis on activities which used labor during one peak period, a near doubling of the interest rates decreased the area's aggregate farm income by only 1.9 million pesos or 7.5 percent.

The effects of higher interest rates on farm organizations and size of enterprises were small (Appendix Tables 16 and 17). As interest rates increased, there was an increase in partially mechanized rice production. Double cropping of com entered the programming solution at the highest

interest rates for the 25,000 peso income level. There was a decrease in the pasture management level and in the size of the livestock activities.

As the interest rate increased, the number of hectares in the minimum size unit for specified incomes increased as shown in Table 7. Each 1 percent increase in interest rate required about a .9 percent increase in land area.

Increased interest rates had a decreasing effect on the total operating capital requirements. Resources were shifted to less capital intensive methods of producing the enterprises. The magnitude of the effect of interest rates on total operating capital requirements decreased as interest rates increased. Labor iequirements increased only slightly with higher interest rates.

Interest rates had no effect on the optima1 mix of enterprises for the area, although increasing capital costs encouraged use of more intensive levels of management. Area farm income and the number of family units in the area decreased slightly as interest rates increased.

Effects of Increases in Hired Wage Rates

The optimum organization of farm family units for the 15,000 and 25,000 peso income levels and four different wage rates are considered in this section. Incraasing wage rates had negligible effects on land requirements. A moderate increasing effect on operating capital requirements occurred. A shift to enterprises that more fully utilized operator and family labor occurred as the wage rate for hired labor was increased.

Increasing the wage rate affected organization by encouraging additional use of farm family labor and reducing hired labor. The quantity of total labor required increased as the hired wage rates were increased

Table 7.--Resource requirements for a 15,000 and 25,000 peso net income for alternative levels of interest rates and average yields and land quality, Cordoba II Project, Lower Sinu River Valley of Colombia

Interest rate	Item	Unit	Income level	
			15,000 pesos	25,000 pesos
Base[a]	Land	Hectares	3.9	7.1
	Operating capital	Pesos	18,778	36,611
	Total labor	Man-days	291.2	391.0
+ 3%	Land	Hectares	4.0	7.3
	Change[b]	Percent	2.6	2.8
	Operating capital	Pesos	16,973	33,397
	Change	Percent	-9.6	-8.8
	Total labor	Man-days	292.5	394.0
	Change	Percent	.4	.7
+ 6%	Land	Hectares	4.1	7.5
	Change	Percent	5.1	5.6
	Operating capital	Pesos	17,396	34,264
	Change	Percent	-7.4	-6.4
	Total labor	Man-days	295.1	399.3
	Change	Percent	1.3	2.1
+ 9%	Land	Hectares	4.2	7.7
	Change	Percent	7.7	8.5
	Operating capital	Pesos	17,842	35,209
	Change	Percent	-5.0	-3.8
	Total labor	Man-days	297.9	405.1
	Change	Percent	2.2	3.6

[a]Base interest rates are 9 percent on crop and livestock operating capital and ll percent on machine capital.

[b]Change from base interest rates.

until a rate of 19 pesos per day was reached. The quantity of hired labor remained almost constant for wage rates of 15 and 17 pesos per man-day. At a wage rate of 19 pesos and 20 pesos per man-day, hired labor was eliminated from the production units for the 15,000 peso and 25,000 peso income levels, respectively. Changes in hired wage rates had little effect on farm size. As wage rates were increased, more efficient use of operator and family labor held the area income loss to about 1.4 percent.

Varying the wage rates of hired labor had a ver-y minor effect on farm organization (Appendix Tables 18 and 19). At the highest wage rates double cropping of com replaced some cotton and thus used operator and family labor more fully.

The minimum quantity of land required for the specified income level was only slightly affected in an upward direction as shown ín Table 8. At the 15,000 peso income leve1 no effect of increased wage rates on land requirements was apparent from the programmed results. This was because of the high utilization of the operator and family labor on the farm units. Capital requirements increased slightly in an almost linear relation with the increased wage cost.

As wage rates increase, managers will need to reallocate present resources to take advantage of unused family labor. An example of this is indicated by the introduction of a double cropping system.

The change in hired wage rates had no effect on the number of family units or area income for the 15,000 peso income level. This was because the units relied almost entirely on operator and family labor. At the 25,000 peso income level, area income and the number of family units in the area decreased slightly when the wage rate on hired labor was increased ta 17 pesos per day. For further wage rate increases, no change occurred in the number of family units or area income.

Table 8.--Resource requirements for a 15,000 and 25,000 peso net income for alternative wage rates and average land quality and yields, Cordoba II Project, Lower Sinu River Valley of Colombia

Wage[a]	Item	Unit	Income level	
			15,000 pesos	25,000 pesos
Base of 15 pesos	Land	Hectares	3.9	7.1
	Operating capital	Pesos	18,778	36,611
	Total labor	Man-days	291.2	391.0
17 pesos	Land	Hectares	3.9	7.2
	Change[b]	Percent	0.0	1.4
	Operating capital	Pesos	18,810	36,982
	Change	Percent	1.7	1.0
	Total labor	Man-days	291.4	393.1
	Change	Percent	0.0	0.5
13 pesos	Land	Hectares	3.9	7.2
	Change	Percent	0.0	1.4
	Operating capital	Pesos	18,846	37,377
	Change	Percent	3.6	2.1
	Total labor	Man-days	291.5[c]	395.0
	Change	Percant	0.1	1.0
20 pesos	Land	Hectares	3.9	7.2
	Change	Percent	0.0	1.4
	Operating capital	Pesos	18,846	37,643
	Change	Percent	3.6	2.8
	Total labor	Man-days	291.5[c]	385.0
	Change	Percent	0.1	-1.5

[a]Rate paid for one man-day of labor.

[b]Change from base hired wage rate.

[c]No labor was hired with wage rate of 19 pesos per day.

Effects of Reductíons ín the Príce of Cotton

Cotton was íncluded ín the farm enterprise mix of all the programming solutions. Therefore, the príce of cotton was varíed to determine its effects on farm size, capital requirements, labor requirement, enterprise mix, area income and number of famíly unít in the area. This analysís is partícularly relevant for future decísíons concerning the price support program for cotton ín Colombia.

In the programming analysís, the gross revenue from cotton was varied downward at 500 peso íncrements until cotton díd not enter the optimum enterprise mix for the 15,000 peso and 25,000 peso income levels. The effects on farm organízatíon of decreasíng the revenue from cotton are shown in Appendix Tables 20 and 21. As the price of cotton decreased, production was shifted to a double-cropped corn enterprise. A small increase in pasture also occurred. When cotton was dropped from the enterprise altematíves, corn replaced cotton on all the land formerly used by cotton. A decrease in the príce of cotton íncreased the quantíty of land required to obtain the specified income levels. The total operating capital requirements tended to increase as the príce of cotton was reduced. Total labor requirements íncreased slíghtly as long as cotton was still included ín the enterprise mix, but dropped when it was excluded. Hired labor was eliminated after the fírst price drop in al1 solutions. A 500 peso decrease in gross retums per hectare is equivalent to a price decrease of .2 pesos per kílogram. Thus, wíth only a slight decrease in the príce of cotton, the optímum enterprise combination excludes cotton production ín the area. Thís result points to the importance of maíntaíníng príce support programs for cotton if its production ís to be encouraged ín the area.

As farm size increased, the number of family units poesible in the area decreased, and the range of an individual farmer's possible income increased because of the increaeed size of unit required for a specified income level.

The minimum resource requirements for the two epecified income levels are shown in Table 9. The minimum land required increased for each incrementa1 decrease in cotton price until cotton was eliminated from the enterprise mix. Total operating capital requirements also increased with each reduction in the price of cotton. Labor requirements increased only slightly and even dropped when cotton wao withdrawn from the enterprise mix for the 25,000 peso income level.

Price reductions reduced the overa11 area farm income and the number of farm family units that can obtain the specified income. The elimination of cotton also reduced the overa11 employment in the area. However, the elimination of cotton permitted making greater use of operator and family labor.

Effects of Reductions in the Price of Rice

The optimum solutions for the specified income levels all included some leve1 of rice production. Rice is especially well adapted to the heavy humid soils of the area and will likely become increasingly important in the area. Changes in price levels will affect the optimum size unit required to utilize operator and family labor and attain the specified income levels.

The optima1 organization of enterprises for the 15,000 and 25,000 peso income levels at different price levels for rice and one without rice production were programmed. The effect of decreasing the price of rice was to increase the size of unit required to obtain the epecified

Table 9.--Resource requirements for a 15,000 and 25,000 peso net income for variable cotton prices and average land quality and yields, Cordoba II Project, Lower Sinu River Valley of Colombia

Cotton price	Item	Unit	Income level	
			15,000 pesos	25,000 pesos
Base	Land	Hectares	3.9	7.1
	Qperating captial	Pesos	18,778	36,611
	Total labor	Man-days	291.2	391.0
500 peso decrease	Land	Hectares	4.3	7.6
	Change[a]	Percent	10.3	7.0
	Operating capital	PESOS	20,892	39,681
	Change	Percent	11.3	8.4
	Total labor	Man-days	302 1	395
	Change	'Percent	3.4	.0
1,000 peso decrease	Land	Hcctares	4.6[b]	8.0
	Change	Percent	17.9	12.7
	Operating capital	Pesos	24,640	42,772
	Change	Percent	31.2	16.8
	Total labor	Man-days	298.8	396.7
	Change	Percent	2.6	1 5
No cotton	Land	Recta nes	4.6	8.0
	Change	Percent	17.9	12.7
	ûperating capital	Pesos	24,640	44,305
	Change	Percent	31.2	20.5
	Total labor	Man-days	298.8	372.5
	Change	Percent	2.6	-4.7

[a]Change from base price of cotton.

[b]No cotton entered the soiution at a gross retum 1,000 pesos bel w the Dase gross return per hectare.

income levels. Operating capital requirements varied directly with the size of the farm unit in the case of a 15,000 peso income level. For the 25,000 peso income level, operating capital requirements increased due to an increase in farm size and a readjustment of the optimal enterprise mix when rice was eliminated. The labor requirements genemlly increased as the price of rice declined except in the case of no rice at a 15,000 peso income where shifting to livestock enterprises reduced the total labor requirement. The optimum organizations for the 15,000 and 25,000 peso income levels with a declining price for rice are shown in Appendix Tables 22 and 23. The basic solution and the effects of varying the price of rice and of excluding rice are shown in Table 10.

Reducing the price of rice decreased the number of family units in the area and decreased area net farm income. Elimination of rice from the enterprise mix decreased area farm income by 3.5 and 4.5 million pesos for the 15,000 peso and 25,000 peso income levels, respectively.

The large potential for expansion of rice production presents important considerations for INCORA policy makers. Rice production could easily be tripled with only small increases in inputs. This could have a tremendous effect on area output and area income, and cause considerable reallocation of production resources.

SUMMARY AND CONCLUSIONS

A number of optimal farm organizations, employing the minimum hectares of land required to produce a net farm income of 15,000 pesos and 25,000 pesos, were developed for the Cordoba II Project area. Different organizations resulted from different assumptions regarding yields, interest on borrowed capital, costs of hired labor, and prices received for cotton and rice.

Table 10.--Resource requirements for a 15,000 and 25,000 peso net income for variable rice prices and average land quality and yields, Cordoba II Project, Lower Sinu River Valley of Colombia

Price of rice	Item	Unit	Income level	
			15,000 pesos	25,000 pesos
Base	Land	Hectares	3.9	7.1
	Operating capital	Pesos	18,778	36,611
	Total labor	Man-days	291.2	391.0
1,000 peso decrease	Land	Hectares	4.2	7.8
	Change[a]	Percent	7.7	9.9
	Operating capital	Pesos	20,665	35,752
	Change	Percent	10.0	-2.3
	Total labor	Man-days	301.8	412.3
	Change	Percent	3.5	5.4
2,000 peso decrease	Land	Hectares	4.6	8.3[b]
	Change	Percent	17.9	16.9
	Operating capital	Pesos	29,014	51,967
	Change	Percent	54.5	41.9
	Total labor	Man-days	317.1	447.8
	Change	Percent	8.9	14.5
No rice	Land	Hectares	4.7	8.3
	Change	Percent	20.5	16.9
	Operating capital	Pesos	35,958	51,967
	Change	Percent	91.5	41.9
	Total labor	Man-days	262.9	447.8
	Change	Percent	-9.7	14.5

[a] Change from base price of rice.

[b] No rice entered the solution at a gross return 2,000 pesos below the base gross return per hectare.

When yields on crops and livestock were increased from average to 1.3 times above average, the minimum hectares of land required to produce a nrt farm income of 15,000 pesos declined from 3.9 to 3.1 hectares. L'or a 25,000 peso net income *the* decline was from 7.1 to 5.6 hectares. A reduction of yields by 10 percent from the average leve1 increased minimum land requirements by 1.4 hectares for the 15,000 peso net income and by 2.8 hectares for the 25,000 peso net income.

Since participants ín the Cordoba II Project possess very little capital, INCORA provides to them investment capital and operating capital at interest rates substantially below those exisitng in the private capital market. Interest rates were increased from the base leve1 of 9 percent on crop and livestock operating capital and 11 percent on machinery capital to levels consistent with the private capital market. Each 1.0 percent increase in the interest rate on borrowed capital reeulted in about a .9 percent increase ín the minimum hectares of land required to obtain the specified income levels.

Cotton and rice were major enterprises in the optimal organizations developed in this analysis, and both require large amounts of labor. Consequently, it was believed that substantial variations in the price of hired labor would greatly affect the hectares of land needed to produce the given levels of net farm income. However, when the wage rate on hired labor was increased from the base leve1 of 15 pesos per man-day up to 20 pesos, there was ptactically no change in the minimum farm sise. This resulted from shifts to enterprises that more fully utilized operator and family labor.

A very small reduction in the price of cotton, about .2 to .4 pesos per kilogram, resulted in its elimination from the optimum enterprise

combination on the programmed farms. This result emphasises that cotton production in the area is dependent on maintaining the current leve1 of price support programs.

Implications for Farm Planning

The motives and objectives of INCORA and those of farm operators and the area resources available must be considered In evaluating the potential farm organization for the area. The potential number of co-operative farms and the number of families for the area as given in Table 6 has no meaning unless a single development criterion is selected. The minimum resource requirements presented should be more useful for evaluating the type and size of farm units to establish in the study area if consideration is given to characteristics of the peasant producer.

The characteristics of the peasant farmer groups are:

(a) The 15,000 peso income leve1 represents the return to operator and family owned resources which is about equivalent to the national average per capita fncome for a family of nine persons. The peasant operator has little or no capital, has low levels of knowledge of technical production, displays poor marketing skills, and possesses limited entrepreneurial experience. INCORA will need to provide technical assistance, credit, marketing assistance, land, and some physical production inputs. The operator and his family must provide the majority of the labor requirements. The inputs required for this income leve1 are 3.9 hectares of average land with average yields and a total of 18,778 pesos of operating capital.

(b) The 25,000 peso income leve1 represents the return to operator and family owned resources of a more highly motivated family. This family may have a very small amount of capital, some knowledge of technical production, limited marketing skill or knowledge of markets, and some entrepreneurial ability. The minimum resources required for this income leve1 under conditions of average yields are 7.1 hectares of average quality land and 36,611 pesos of operating capital.

Implications for Area Planning

At present, most peasant operators fa11 into one of the two above groups. The potential for adjustments over a period of time is greatly

influenced by which class will dominate the area.

Some other limits on the adjustments that peasant operators can make over extended time are implied by equity levels, land transfer requirements, market potentials, limits on fann size, and family consumption levels. In the future, increases in equity for owned resources will allow farm incomes to increase. Technological improvements and efforts to increase individual entrepreneurial abilities will greatly influence area income.

REFERENCES

1. Eustanente, Heliodoro, J. L. Espana, and Adolfo Correa. 1967. Clasificación de Tierras Para Obras de Irrigación y Drenaje; Sector Monteria - Cerete. Bogota: Instituto Geografico Agustin Codazzi.

2. Economic and Engineering Study, Marketing and Storage Facilities for Grain and Tuberous Crops in Colombia. 1965. Kansas City: Departmento Administrativo de Planeacion through the Banco de la Republica, Weitz-Hettlelsater Engineers.

3. Havens, A. Eugene, Eduardo L. Montero, and Michel Romieux. May, 1965. Cerete - Un Area de Latifundio, Estudio Económico y Social. No. 3. Bogota: Universidad Nacional de Colombia.

4. Meyer, Neil Larry. "Minimum Resource Requirements for Specified Levels of Income on Crop-livestock Farms in the Sinu River Valley of Colombia," (unpublished M.S. Thesis, University of Florida, 1969), pp. 166.

APPENDIX

Footnotes to Appendix Tables 1 through 8

[a] Tons are metric units (2205 lbs.).

[b] This estimate is the return to land, capital, labor, management and risk. All return estimates implicitly include a return to overhead capital. Seasonal hired labor costs, interest on operating capital, and annual cost of land is determined by the programming procedure.

[c] Includes a 6% shrinkage during hauling to market.

[d] AUM is Animal Unit Months of grazing.

Appendix Table 1.--Cotton (partially mechanized): Estimated production requirements and income per hectare, Lower Sinu River Valley of Colombia

Item	Description	Unit	Price or cost per unit	Quantity	Value or cost
			Pesos		Pesos
(1) Total income	Cotton fiber and seed	tons[a]	3,700.00	2.5	9,250.00
(2) Specified variable expenses					
Clipping	Custom (MF165-72" clipper)	ha.	70.00	1	70.00
Plowing	Custom (MF165-4 disk)	ha.	200.00	2	400.00
Disking	Custom (MF165-9' tandem)	ha.	70.00	4	280.00
Planting	Custom (MF165-4 row)	ha.	70.00	1	70.00
Seed	Adapted variety	kg.	2.50	30	75.00
Cultivating	Custom (MF165-4 row)	ha.	60.00	1	60.00
Hilling	Custom (MF165-4 row)	ha.	60.00	1	60.00
Fertilizer	14-14-14 (with planting)	kg.	1.68	200	336.00
Fertilizer	Urea (46% N)	kg.	1.90	100	190.00
Spraying	Custom (airplane)	ha.	25.00	10	250.00
Insecticides					
Toxefeno-DDT (40-20)		gal.	45.30	1	45.30
Methyl-Parathion 40 (48%)		gal.	75.45	2.55	192.40
Sevin 80		lb.	16.30	25	407.50
Ekatin (25%)		liter	35.00	.3	10.50
Sacks		each	6.00	72	432.00
Farm transport	Custom (tractor and wagon)	ton	12.00	2.5	30.00
Transport to gin	Custom (tractor and wagon)	sack	1.50	72	108.00
Unload at gin		sack	.30	72	21.60
Technical assistance		ha.	90.00	1	90.00
(3) Total specified costs					3,128.30
(4) Net return over specified costs[b]					6,121.70

Footnotes cited on page 37.

Appendix Table 2.--Rice (mechanized): Estimated production requirements and income per hectare, Lower Sinu River Valley of Colombia

Item	Description	Unit	Price or cost per unit	Quantity	Value or cost
			Pesos		Pesos
(1) Total income	Rice paddy	tons[a]	1,800.00	3.75	6,750.00
(2) Specified variable expenses					
Plowing	Custom (MF165-4 disk)	ha.	200.00	1	200.00
Disking	Cus tom (MF165-9' tandem)	ha.	70.00	3	210.00
Planting	Custom (MF165-drill)	ha.	70.00	1	70.00
Seed	Adapted variety	kg.	4.37	150	655.50
Fertilizer	10-10-10 (with planting)	kg.	1.63	200	326.00
Fertilizer	Urea (46% N)	kg.	1.90	75	142.50
Spraying	Custom (MF165-sprayer)	ha.	30.00	2	60.00
Spraying	Custom (airplane)	ha.	25.00	3	75.00
Fungicide	Antraco (with seed)	lb.	1.00	5	5.00
Herbicide	Stam F-34	gal.	161.00	2.5	402.50
Herbicide	Fede-Arroz 500	gal.	107.00	.67	71.69
Insecticides					
Toxefeno-DDT (40-20)		gal.	45.30	1.28	57.98
Sevin 85		lb.	16.00	5	80.00
Ekatin (25%)		liter	35.00	.3	10.50
Aldrin	(With seed)	kg.	2.25	5	ll.25
Combining	Custom	sack	10.00	75	750.00
Sacks		each	4.00	75	300.00
Farm transport	Custom (tractor and wagon)	sack	.30	75	22.50
Transport to market	Custom (tractor and wagon)	sack	1.50	75	112.50
Technical assistance		ha.	60.00	1	60.00
(3) Total specified costs					3,622.92
(4) Net returns over specified costs[b]					3,127.08

Footnotes cited on page 37.

Appendix Table 3.--Rice (partially mechanized): Estimated production requirements and income per hectare, Lower Sinu River Valley of Colombia

Item	Description	Unit	Price or cost per unit	Quantity	Value or cost
			Pesos		Pesos
(1) Total income	Rice paddy	tons[a]	1,800.00	3.75	6,750.00
(2) Specified variable expenses					
Plowing	Custom (MF165-4 disk)	ha.	200.00	1	200.00
Disking	Custom (MF165-9' tandem)	ha.	70.00	3	210.00
Planting	Custom (MF165-drill)	ha.	70.00	1	70.00
Seed	Adapted variety	kg.	4.37	150	655.50
Fertilizer	10-10-10 (with planting)	kg.	1.63	200	326.00
Fertilizer	Urea (46% N)	kg.	1.90	75	142.50
Spraying	Custom (MF165-sprayer)	ha.	30.00	2	60.00
Spraying	Custom (airplane)	ha.	25.00	3	75.00
Fungicide	Antraco (with seed)	lb.	1.00	5	5.00
Herbicide	Stam F-34	gal.	161.00	2.5	402.50
Insecticide					
Toxefeno-DDT (40-20)		gal.	45.30	1.28	57.98
Sevin 85		lb.	16.00	5	80.00
Ekatin (25%)		kg.	35.00	.3	10.50
Aldrin (with seed)		kg.	2.25	5	11.25
Sacks		each	4.00	75	300.00
Transport to market	Custom (tractor and wagon)	sack	1.50	75	112.50
Technical assistance		ha.	60.00	1	60.00
(3) Total specified costs					2,778.73
(4) Net return over specified costs[b]					3,971.27

Footnotes cited on page 37.

Appendix Table 4.--Corn (mechanized): Estimated production requirements and income per hectare, *Lower* Sinu River Valley of Colombia

Item	Description	Unit	Price or cost per unit	Quantity	Value or cost
			Pesos		Pesos
(1) Total income	Shelled com	ton[a]	1,300.00	3.5	4,550.00
(2) Specified variable expenses					
Plowing	Custom (MF165-4 disk)	ha.	200.00	1	200.00
Disking	Custom (MF165-9' tandem)	ha.	70.00	3	210.00
Planting	Custom (MF165-4 row)	ha.	70.00	1	70.00
Seed	H-104 variety	kg.	4.50	25	112.50
Fertilizer	14-14-14 (with planting)	kg.	1.68	200	336.00
Fertilizer	Urea (46% N)	kg.	1.90	100	190.00
Herbicide	Gesaprin (80%)	kg.	62.25	2.5	155.62
Spraying	Custom (MF165-sprayer)	ha.	30.00	1	30.62
Spraying	Custom (airplane)	ha.	25.00	1	25.00
Insecticides					
Aldrin		kg.	2.25	1	2.25
Cebicid	Granular (2.5%)	kg.	3.12	25	78.00
DDT	(35%)	gal.	33.00	1.6	52.80
Sacks		each	4.00	70	280.00
Farm transport	Custom (tractor and wagon)	sack	.30	134	40.20
Shelling	Custom (MF165-sheller)	ton[a]	49.00	3.5	171.50
Transport to market	Custom (tractor and wagon)	sack	1.50	70	105.00
Technical assistance		ha.	50.00	1	50.00
(3) Total specified costs					2,108.87
(4) Net return over specified costs[b]					2,441.13

Footnotes cited on page 37.

Appendix Table 5.--Corn (pertiaily mechanized): Estimated production requirements and income per hectare, Lower Sinu River Valley of Colombia

Item	Description	Unit	Price or cost per unit	Quantity	Value or cost
			Pesos		Pesos
(1) Total income	Shelled corn	tons [a]	1,300.00	3.5	4,550.00
(2) Specified variable expenses					
Plowing	Custom (MF165-4 disk)	ha.	200.00	1	200.00
Disking	Custom (MF165-9' tandem)	ha.	70.00	3	210.00
Planting	Custom (MF165-4 row)	ha.	70.00	1	70.00
Seed	H-104 variety	kg.	4.50	25	112.50
Fertilizer	14-14-14 (with planting)	kg.	1.68	200	336.00
Fertilizer	Urea (46% N)	kg.	1.90	100	190.00
Spraying	Custom (airplane)	ha.	25.00	1	25.00
Cultivating	Custom (MF165-4 row)	ha.	60.00	1	60.00
Insecticides					
Aldrin		kg.	2.25	1	2.25
Cebicid	Granular (2.5%)	kg.	3.12	25	78.00
DDT	(35%)	gal.	33.00	1.6	52.80
Sacks		each	4.00	70	280.00
Farm transport	Custom (tractor and wagon)	sack	.30	134	40.20
Shelling	Custom (MF165-sheller)	ton [a]	49.00	3.5	171.50
Transport to market	Custom (tractor and wagon)	sack	1.50	70	105.00
Technical assistance		ha.	50.00	1	50.00
(3) Total specified costs					1,983.25
(4) Net return over specified costs [b]					2,566.75

Footnotes cited on page 37.

Appendix Table 6.--Purchased fattening bulls: Estimated production requirements and income per head, Lower Sinu River Valley of Colombia

Item	Unit	Rate	Number	Price or cost per unit	Total quantity	Value or cost
				Pesos		Pesos
(1) Livestock investment						
Feeder bull	head	360 kg.	1	1,750.00	1	1,750.00
(2) Production						
Fat bull	head	441 kg.[c]	1	2,400.00	1	2,400.00
Less 3% death loss						72.00
Total income						2,328.00
(3) Inputs						
Salt and mineral	kg.		.58	.72	7	5.04
Veterinary and medical	peso/head		1.0	4.72		4.72
Equipment depreciation	peso/head		1.0	27.95		27.95
Transport to market	peso/head		1.0	150.00	2328	150.00
Market commission	peso	2%				46.56
(4) Total specified costs						1,984.27
(5) Net return over specified cost[b]						343.73

Footnotes cited on page 37.

Appendix Table 7.--Beef cows (best management): Estimated production requirements and income for a 100-cow herd and per cow unit, Lower Sinu River Valley of Colombia

Item	Unit	Rate	Number	Price or cost per unit	Total quantity	Total value or cost	Value or cost per cow unit
				Pesos		Pesos	Pesos
(1) Livestock investment							
Mature cows	head	400 kg.	100	1,400	100	140,000	
Rreeding bulls	head	625 kg.	4	800	4	32,000	
Replacement bu11	head	375 kg.	1	5,500	1	5,500	
Replacement heifers	head	325 kg.	18	1,400	18	25,200	
Heifers (over 2 yrs.)	kg.	411	24	3.61	9,864	35,609	
Heifers (coming 2 yrs.)	head	325 kg.	43	1,400	43	60,200	
Heifers (coming 1 yr.)	head	243 kg.	44	800	44	35,200	
Beef bulls (over 2 yrs.)	kg.	437	43	4.44	18,791	83,432	
Beef bulls (coming 2 yrs.)	head	325 kg.	44	1,700	44	74,800	
Beef bulls (coming 1 yr.)	head	243 kg.	45	825	45	37,125	
Total investment						529,066	5,290.66
(2) Production							
Cull cows	head		15	1,900	15	28,500.00	
Fat heifers	kg.	386[c]	24	4.61	9,264	42,707.07	
Fat bulls	kg.	411[c]	43	5.44	17,673	96,141.12	
Total income						167,348.19	1,673.48
(3) Inputs							
Salt and minerals							
Cows and bulls	kg.	15.0	104	.72	1,560	1,123.20	
Heifers and bulls (over 2 yrs.)	kg.	12.0	86	.72	1,032	743.04	
Heifers and bulls (coming 2 yrs.)	kg.	10.2	87	.72	887.4	638.93	
Heifers and bulls (coming 1 yr.)	kg.	7.2	89	.72	640.8	461.38	

Continued

Appendix Table 7.--Beef cows (best management): Estimated production requirements and income for a 100-cow herd and per cow unit, Lower Sinu River Valley of Colombia--Continued

Item	Unit	Rate	Number	Price or cost per unit	Total quantity	Total value or cost	Value or cost per cow unit
				Pesos		Pesos	Pesos
Veterinary and medical							
Cows	peso/head		100	16.64		1,664.00	
Breeding bulls	pesojhead		5	6.64		33.20	
Beef bulls and heifers (over 1 yr.)	pesojhead		172	6.64		1,142.08	
Beef heifers (coming 1 yr.)	pesojhead		44	9.70		426.80	
Beef bulls (coming 1 yr.)	peso/head		45	6.10		274.50	
Equipment depreciation	peso		1	3,932.00		3,932.00	
Bull depreciation	peso		4	1,313.00		5,252.00	
Transport to market	peso		82	150.00		12,300.00	
Market commission	peso	2%			167,348.19	3,346.96	
(4) Total specified costs						31,338.09	313.38
(5) Net return over specified costs[b]						136,010.10	1,360.10

Footnotes cited on page 37.

Appendix Table 8.--Para pasture: Estimated production and annual costs per hectare for improved management and best management practices, Lower Sinu River Valley of Colombia

Item	Unit	Price or cost per unit	Improved management		Best management	
			Quantity	Value or cost	Quantity	Value or cost
		Peso		Peso		Peso
(1) Production						
Grazing (Dec.-Mar.)	AUM[d]		6		8	
Grazing (Apr.-Nov.)	AUM		32		44	
(2) Specified variable expenses						
Annual charge for establishment	ha.	109.00	1	109.00	1	169.00
Fence depreciation	peso/meter	.50	60	30.00	60	30.00
Urea (46% N)	kg.	1.90			200	380.00
(3) Total specified costs				139.00		519.00

Footnotes cited on page 37.

Appendix Table 9.--Labor requirements for enterprisas appearing in the optima1 organizations[a]

Month	Cotton, PB 1-hectare	Rice, MB 1-hectare	Rice, PB 1-hectare	Corn, MB 1-hectare	Corn, PA 1-hectare	Corn, PB 1-hectare	Fatten-ing bulls 1-animal	Beef Cow, BM 1-cow unit	Pasture IM 1-hectare	Pasture BM 1-hectare
					-Man-days					
January	40.0	--	--	--	--	--	--	.02	--	--
February	7.0	--	--	--	--	--	--	.02	--	--
March	--	--	--	--	--	--	--	.08	.3	.3
April	--	--	--	--	--	--	.07	.08	--	--
May	--	--	--	--	.13	--	.07	.08	--	6.1
June	--	--	--	--	15.5	--	.07	.28	6.1	--
July	--	.13	2.13	--	--	--	.07	.02	--	6.1
August	.13	2.0	12.0	2.63	12.0	.13	.07	.02	--	--
September	3.0	2.0	2.0	2.0	--	5.5	.07	.02	--	6.1
October	14.0	2.0	--	--	5.25	--	.07	.04	6.1	--
November	8.0	1.0	1.0	5.0	--	12.2	--	.04	.3	6.4
December	10.0	--	112.5	12.25	--	5.25	--	.22	--	--
Total	82.13	7.13	129.63	21.88	32.88	32.88	.49	.92	12.8	25.0

[a]One man-day equivalent to ten man-hours. Ekplanation of the enterprise codes are as follows:
PB--partially mechanized production in Semester B
MB--mechanized production in Semester B
PA--partially mechanized production in Semester A
BM--best managed herd or pasture sgstem
IM--improved management on pasture

Appendix Table 10.--Power and machinery requirements for crop enterprises appearing in the optimal organizations[a]

Month	Cotton, PB 1-hectare	Rice, MB 1-hectare	Rice, PB' 1-hectare	Corn, MB 1-hectare	Corn, PA 1-hecarre	Corn, PB 1-hectare
			Hours			
January	.25	--	--	--	--	--
February	2.0	--	--	--	--	--
March	1.0	--	--	--	--	--
April	--	--	--	--	3.0	--
May	--	--	--	--	3.0	--
June	--	--	--	--	1.0	--
July	3.0	1.0	--	--	--	--
August	3.0	3.0	2.0	3.0	1.0	3.0
September	2.0	3.0	3.0	3.5	--	3.0
October	1.0	1.0	1.0	--	--	1.0
November	--	--	1.0	--	1.25	--
December	--	.25	--	1.25	--	2.25
Total	12.25	7.25	7.0	7.75	8.25	8.25

[a]Does not include machine time of custom combine. Explanation of the enterprise codes are as follows:
PB--partially mechanized production in Semester B
MB--mechanized production in Semester B
PA--partially mechanized production in Semester A

Appendix Table ll.--Total investment, salvage value, expected life, and estimated costs per hour for machinery and equipment

Item	Initial cost	Salvage value	Expected life	Repair cost as % of initial cost	Depreciation charges per hour	Operating costs	
						Repair costs per hour	Fuel and oil costs per hour
	Pesos	Pesos	Hours	Percent	Pesos	Pesos	Pesos
Tractor (65 HP)	69,000	17,250	12,000	108	7.76[a]	9.32[a]	8.40[a]
Plow (4 disk)	13,000	1,300	2,500	108	5.15	5.62	--
Disk (9 ft. tandem)	16,000	1,600	2,500	108	5.76	6.91	--
Cuftivator (4 row)	16,500	1,650	2,500	108	5.94	7.13	--
Tractor mounted sprayer	5,000	500	1,200	72	3.75	3.00	--
Planter (4 row)	18,600	1,860	1,200	90	13.95	13.95	--
Dril1 (10 ft.)	18,600	1,860	1,200	90	13.95	13.95	--
Rotary clipper (72 inch)	14,500	1,450	2,000	54	6.53	3.92	--
Corn sheller (4 ton/hour)	13,500	1,350	1,500	54	8.10	4.86	6.30
Combine (14 ft. rice)	280,000	28,000	2,000	54	126.00	75.60	20.00
Wagon (4 ton)	9,130	913	5,000	90	2.45[a]	2.45[a]	--

[a]Estimated on the basis of two-thirds available time used in farm production.

Appendix Table 12.--Estimated total power and machine days and hours available by months and periods, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	Period I		Period II				Period III			Period IV			Total
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
Power and Machine days[a]	22	19	21	16	16	14	13	14	18	16	20	18	207
Power and Machine hours[b]	220	190	210	160	160	140	130	140	180	160	200	180	2,070

[a]Power and machine days based on six days per week with deletions for rain (20-50 mm. in one day or 60 mm. in two consecutive days, delete two days, more than 50 mm. in one day, delete three days) and local, religious and national holidays.

[b]Based on 10 hours per day not including service and maintenance.

Appendix Table 13.--Definition of land resource eituations and yield levels by productivity clase, Cordoba II Project, Lower Sinu River Valley of Colombia

Land class	Definition
1	Light to heavy texture; deep topsoil; medium well-drained to imperfectly drained; suitable for shallow rooted crops.
II	Heavy texture; moderately deep, leve1 topsoil; imperfectly drained; suitable for shallow rooted crops.
III	Lower elevation; heavy texture; moderately deep, level topsoil, often high in organic matter; poorly drained; suitable for rice and pasture production; with drainage can be transferred to Class II land.
IV	Soils similar to Class III land, but very poorly drained; suitable only for pasture; limited possibility for water control.

Enterprise	Type of fertilizer	Units of yield[a]	Yield by land class			
			1	II	III	IV
Cotton	14-14-14 and Urea (46%~)	tons/ha.	2.5	2.375	NR[b]	NR
Corn	14-14-14 and Urea (46%~)	tons/ha.	3.5	3.325	NR	NR
Rice	10-10-10 and Urea (46%)	tons/ha.	4.0	3.8	3.8	NR
Para pasture (improved management)						
Dry season	none	AUM/ha.[c]	6.0	6.0	6.0	6.0
Wet season	none	AUM/ha.	32.0	32.0	32.0	32.0
Para pasture (best management)						
Dry season	none	AUM/ha.	8.0	8.0	8.0	8.0
Wet season	Urea (46%N)	AUM/ha.	44.0	44.0	44.0	44.0

[a]Tons are metric units (2205 lbs.); AUM is Animal Unit Months.

[b]NR--not recommended on these types of soils.

[c]Native Para pasture under traditional management yields 2.0 AUM's of grazing during the dry season and 12.0 AUM's during the wet season.

Appendix Table 14.--Land class composition, valuation, and estimated costs of ownership per hectare for average quality land, Cordoba II Project, Lower Sinu River Valley of Colombia

Land class	Value per hectare[a]	Land class composition per representative hectare	Value
	Pesos	Percent	Pesos
I	22,000	54	11,880
II	17,000	7	1,190
III	14,000	25	3,500
IV	2,000	14	280
Total value			16,850

Prorated cost of registration, transfer and other legal fees[b]	Municipal tax[c]	Interest on land capital[d]	Annual cost of land
	Pesos		
13	68	674	755

[a] INCORA records in Monteria, Obres de Adecuacion-Costo, from legal and engineering departments.

[b] 12 pesos registration and 1 peso transfer and other legal fees.

[c] Based on a rate of 4 pesos per 1,000 pesos value.

[d] INCORA land loans have a 4 percent annual interest rate.

Appendix Table 15.--Man-equivalent days of labor available by months, Cordoba II Project, Lower Sinu River Valley of Colombia

Seasonal time periods	Months	Operator labor[a]	Other family labor[b]	Total man-days per month
Period 1		(47)	(57)	(104)
	January	24	35	59
	February	23	22	45
Period II		(94)	(90)	(184)
	March	25	24	49
	April	24	23	47
	May	24	23	47
	June	21	20	41
Period III		(69)	(66)	(135)
	July	24	23	47
	August	21	20	41
	September	24	23	47
Period IV		(72)	(81)	(153)
	October	25	24	49
	November	22	21	43
	December	25	36	61
Year		282	294	576

[a]Operator labor is based on six days per week with deletions for sickness, rain, and local religious and national holidays.

[b]Other family labor is based on .95 additional adult male in the family helping on the farm plus .5 additional man equivalents of labor from school age children during December and January.

Appendix Table 16.--Mínimum land required to produce a net farm income of 15,000 pesos on average quality land with average yields and variable interest rates on operating capital, Cordoba II Project, Lower Sinu Ríver Valley of Colombia

Item	Unit	Leve1 of interest rate			
		Basic[a]	+3%[b]	+6%[c]	+9%[d]
Total land ín farm	Hectares	3.9	4.0	4.1	4.2
Cotton (partially mechanized)	Hectares	2.4	2.4	2.5	2.6
Rice (mechanized)	Hectares	.3	.3	.4	.4
Rice (partially mechanized)	Hectares	.7	.7	.6	.6
Para pasture (improved management)	Hectares		.6	.6	.6
Para pasture (best managed)	Hectares	.5			
Livestock					
Beef cows (best managed)	Cow units	.4	.3	.3	.3
Purchased fattening bulls)	Head	1.9	1.4	1.4	1.4
Operator and family labor	Man-days	282.5	282.4	282.6	282.8
Hired labor	Man-days	8.7	10.1	12.5	15.1
Total operating capital	Pesos	18,778	16,973	17,396	17,842
Land investment	Pesos	65,715	67,400	69,085	70,770
Other investment capital	Pesos	2,891	2,414	2,427	2,439
Total income	Pesos	33,389	32,675	33,376	34,116
Crop operating expenses	Pesos	10,393	10,630	10,884	11,151
Pasture and beef operating expenses	Pesos	4,116	2,876	2,938	3,003
Annual interest on operating capital	Pesos	804	997	1,270	1,664
Hired labor expenses	Pesos	131	152	188	227
Returns to land	Pesos	2,945	3,020	3,096	3,171

[a] Interest rate of 9 percent on crop and livestock operating capital and 11 percent on machine capital.

[b] Interest rate of 12 percent on crop and livestock operating capital and 14 percent on machine capital.

[c] Interest rate of 15 percent on crop and livestock operating capital and 17 percent on machine capital.

[d] Interest rate of 18 percent on crop and livestock operating capital and 20 percent on machine capital.

Appendix Table 17.--Minimum land required to produce a net farm income of 25,000 pesos on average quality land with average yields and variable interest rates on operating capital, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	Unit	Level of interest rate			
		Basic[a]	+3%[b]	+6%[c]	+9%[d]
Total land in farm	Hectares	7.1	7.3	7.5	7.7
Corn (partially mechanized)	Hectares				.2
Cotton (partially mechanized)	Hectares	4.3	4.4	4.6	4.6
Rice (mechanized)	Hectares	1.7	1.8	1.8	1.9
Rice (partially mechanized)	Hectares	.1	.1		
Para pasture (improved management)	Hectares		1.0	1.0	1.1
Para pasture (best managed)	Hectares	1.0			
Livestock					
Beef cows (best managed)	Cow units	.7	.5	.5	.6
Purchased fattening bulls	Head	3.4	2.5	2.6	2.6
Operator and family labor	Man-days	289.1	288.8	289.1	294.0
Hired labor	Man-days	102.0	105.2	110.2	111.1
Total operating capital	Pesos	36,611	33,397	34,264	35,209
Land investment	Pesos	119,635	123,005	126,375	129,745
Other investment capital	Pesos	5,157	4,124	3,741	4,755
Total income	Pesos	61,057	59,896	61,332	62,869
Crop operating expenses	Pesos	19,981	20,468	20,987	21,616
Pasture and beef operating expenses	Pesos	7,527	5,273	5,399	5,536
Annual interest on operating capital	Pesos	1,658	2,065	2,630	3,236
Hired labor expenses	Pesos	1,530	1,578	1,653	1,667
Returns to land	Pesos	5,361	5,512	5,663	5,814

[a] Interest rate of 9 percent on crop and livestock operating capital and ll percent on machine capital.

[b] Interest rate of 12 percent on crop and livestock operating capital and 14 percent on machine capital.

[c] Interest rate of 15 percent on crop and livestock operating capital and 17 percent on machine capital.

[d] Interest rate of 18 percent on crop and livestock operating capital and 20 percent on machine capital.

Appendix Table 18.--Minimum land required to produce a net farm income of 15,000 pesos on average quality land with average yields and variable costs of hired labor, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	Unit	Level of hired labor cost		
		15 pesos man-day	17 pesos man-day	19 pesos man-day
Total land in farm	Hectares	3.9	3.9	3.9
Total land utilized	Hectares	3.9	3.9	4.1[a]
Corn (partially mechanized)	Hectares			.4
Cotton (partially mechanized)	Hectares	2.4	2.4	2.2
Rice (mechanized)	Hectares	.3	.3	.3
Rice (partially mechanized)	Hectares	.7	.7	.7
Para pasture (best managed)	Hectares	.5	.5	.5
Livestock				
Beef cows (best managed)	Cow units	.4	.4	.4
Purchased fattening bulls	Head	1.9	1.9	1.9
Operator and family labor	Man-days	282.5	282.6	291.5
Hired labor	Man-days	8.7	8.8	0
Total operating capital	Pesos	18,778	18,810	18,846
Land investment	Pesos	65,715	65,715	65,715
Other investment capital	Pesos	2,891	2,891	2,906
Total income	Pesos	33,389	33,438	33,439
Crop operating expenses	Pesos	10,393	10,410	10,558
Pasture beef operating expenses	Pesos	4,116	4,122	4,126
Annual interest on operating capital	Pesos	804	811	810
Hired labor expenses	Pesos	131	150	
Returns to land	Pesos	2,945	2,945	2,945

[a]Because the corn enterprise is a double crop during the year, the total land utilized exceeds the total land in the farm.

Appendix Table 19.--Minimum land required to produce a net farm income of 25,000 pesos on average quality land with average yields and variable costs of hired labor, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	Unit	Level of hired labor cost			
		15 pesos man-day	17 pesos man-day	19 pesos man-day	20 pesos man-day
Total land in farm	Hectares	7.1	7.2	7.2	7.2
Total land utilized	Hectares	7.1	7.2	7.7[a]	9.5[a]
Corn (partially mechanized)	Hectares			1.0	4.4
Cotton (partially mechanized)	Hectares	4.3	4.4	3.9	2.2
Rice (mechanized)	Hectares	1.7	1.8	1.7	1.6
Rice (partially mechanized)	Hectares	.1		.1	.3
Para pasture (beef managed)	Hectares	1.0	1.0	1.0	1.0
Livestock					
Beef cows (best managed)	Cow units	.7	.7	.7	.7
Purchased fattening bulls	Head	3.4	3.5	3.5	3.5
Operator and family labor	Man-days	289.0	289.1	313.1	385.0
Hired labor	Man-days	102	104	81.9	0
Total operating capital	Pesos	36,611	36,982	37,377	37,643
Land investment	Pesos	119,635	121,320	121,320	121,320
Other investment capital	Pesos	5,157	5,167	5,215	5,350
Total income	Pesos	61,057	61,632	62,096	61,874
Crop operating expenses	Pesos	19,981	20,180	20,735	22,086
Pasture and beef operating expenses	Pesos	7,527	7,598	7,663	7,669
Annual interest on operating capital	Pesos	1,658	1,650	1,706	1,683
Hired labor expense	Pesos	1,530	1,768	1,556	
Returns to land	Pesos	5,361	5,436	5,436	5,436

[a]Because the corn enterprise is a double crop during the year, the total land utilized exceeds the total land in the farm.

Appendix Table 20.--Minimum land required to produce a net farm income of 15,000 pesos on average quality land with average yields and variable prices of cotton, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	Unit	Level of gross revenue from cotton per hectare		
		Basic	Decrease 500 pesos	No Cotton[a]
Total land in farm	Hectares	3.9	4.3	4.6
Total land utilized	Hectares	3.9	4.6[b]	7.4[b]
Corn (partially mechanized)	Hectares		.8	5.6
Cotton (partially mechanized)	Hectares	2.4	2.2	
Rice (mechanized)	Hectares	.3	.4	.4
Rice (partially mechanized)	Hectares	.7	.6	.8
Para pasture (best managed)	Hectares	.5	.6	.6
Livestock				
Beef cows (best managed)	Cow units	.4	.4	.5
Purchased fattening bulls	Head	1.9	2.1	2.2
Operator and family labor	Man-days	282.5	302.1	298.8
Hired labor	Man-days	8.7	0	0
Total operating capital	Pesos	18,778	20,892	24,640
Land investment	Pesos	65,715	72,455	77,510
Other investment capital	Pesos	2,891	3,018	3,780
Total income	Pesos	33,389	35,438	39,094
Crop operating expenses	Pesos	10,393	11,811	14,655
Pasture and beef operating expenses	Pesos	4,116	4,512	4,871
Annual interest on operating capital	Pesos	806	868	1,095
Hired labor expenses	Pesos	130		
Returns to land	Pesos	2,944	3,247	3,473

[a]When gross revenue per hectare is reduced beyond 500 pesos from the basic value, no cotton enters the optimal enterprise organization.

[b]Because the corn enterprise is a double crop during the year, the total land utilized exceeds the total land in the farm.

Appendix Table 21.--Minimum land required to produce a net farm income of 25,000 pesos on average quality land with average yields and variable prices of cotton, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	Unit	Level of gross revenue from cotton per hectare			
		Basic	Decrease 500 pesos	Decrease 1,000 pesos	No cotton[a]
Total land in farm	Hectares	7.1	7.6	8.0	8.0
Total land utilized	Hectares	7.1	10.1[b]	12.0[b]	12.9[b]
Corn (mechanized)	Hectares				2.0
Corn (partially mechanized	Hectares		4.9	8.1	7.8
Cotton (partially mechanized	Hectares	4.3	2.2	.8	
Rice (mechanized)	Hectares	1.7	1.7	1.7	1.7
Rice (partially mechanized	Hectares	.1	.2	.3	.3
Para pasture (best managed)	Hectares	1.0	1.1	1.1	1.1
Livestock					
Beef cows (best managed)	Cow units	.7	.7	.8	.8
Purchased fattening bulls	Head	3.4	3.7	3.8	3.9
Operator and family labor	Man-days	289.0	395.1	396.7	372.5
Hired labor	Man-days	102.0			
Total operating capital	Pesos	36,611	39,681	42,772	44,105
Land investment	Pesos	119,635	128,060	134,800	134,800
Other investment capital	Pesos	5,157	5,461	6,162	6,221
Total income	Pesos	61,057	63,856	66,889	68,212
Crop operating expenses	Pesos	19,981	23,336	25,572	26,696
Pasture and beef operating expenses	Pesos	7,527	8,053	8,419	8,499
Annual interest on operating capital	Pesos	1,659	1,729	1,858	1,977
Hired labor expenses	Pesos	1,530			
Returns to land	Pesos	5,360	5,739	6,040	6,040

[a]When gross revenue per hectare is reduced beyond 1,000 pesos from the basic value, no cotton enters the optimal enterprise organization.

[b]Because the corn enterprise is a double crop during the year, the total land utilized exceeds the total land in the farm.

Appendix Table 22.--Minimum land required to produce a net farm income of 15,000 pesos on average quality land with average yields and variable prices of rice, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	Unit	Level of gross revenue from rice per hectare			
		Basic	Decrease 1,000 pesos	Decrease 2,000 pesos	No rice[a]
Total land in farm	Hectares	3.9	4.2	4.6	4.7
Cotton (partially mechanized)	Hectares	2.4	2.6	2.8	2.9
Rice (mechanized)	Hectares	.3	.5		
Rice (partially mechanized)	Hectares	.7	.6	.5	
Para pasture (best managed)	Hectares	.5	.6	1.3	1.8
Livestock					
Beef cows (best managed)	Cow units	.4	.4	.9	1.3
Purchased fattening bulls	Head	1.9	2.0	4.3	6.3
Operator and family labor	Man-days	282.5	283.3	287.2	228.3
Hired labor	Man-days	8.7	18.5	29.9	34.6
Total operating capital	Pesos	18,778	20,665	29,014	35,958
Land investment	Pesos	65,715	70,770	77,510	79,195
Other investment capital	Pesos	2,891	2,982	5,910	11,880
Total income	Pesos	33,389	35,217	39,807	43,194
Crop operating expenses	Pesos	10,393	11,408	10,222	8,976
Pasture and beef operating expenses	Pesos	4,116	4,477	9,493	13,858
Annual interest on operating capital	Pesos	804	883	1,170	1,292
Hired labor expenses	Pesos	131	278	449	519
Returns to land	Pesos	2,945	3,171	3,473	3,549

[a]When gross revenue per hectare is reduced beyond 2,000 pesos from the basic value, no rice enters the optimal enterprise organization.

Appendix Table 23.--Minimum land required to produce a net farm income of 25,000 pesos on average quality land with average yields and variable prices of rice, Cordoba II Project, Lower Sinu River Valley of Colombia

Item	Unit	Level of gross revenue from rice per hectare		
		Basic	Decrease 1,000 pesos	No rice[a]
Total land in farm	Hectares	7.1	7.8	8.3
Cotton (partially mechanized)	Hectares	4.3	4.7	5.1
Rice (mechanized)	Hectares	1.7	1.9	
Rice (partially mechanized)	Hectares	.1		
Para pasture (improved management)	Hectares		1.1	3.2
Para pasture (best managed)	Hectares	1.0		
Livestock				
Beef cows (best managed)	Cow units	.7	.6	1.7
Purchased fattening bulls	Head	3.4	2.7	8.1
Operator and family labor	Man-days	289.0	290.1	301.9
Hired labor	Man-days	102.0	122.2	145.9
Total operating capital	Pesos	36,611	35,752	51,967
Land investment	Pesos	119,635	131,430	139,855
Other investment capital	Pesos	5,157	4,763	11,342
Total income	Pesos	61,057	61,856	68,254
Crop operating expenses	Pesos	19,981	21,835	15,931
Pasture and beef operating expenses	Pesos	7,527	5,613	16,823
Annual interest on operating capital	Pesos	1,658	1,686	2,044
Hired labor expenses	Pesos	1,530	1,833	2,189
Returns to land	Pesos	5,361	5,889	6,267

[a]When gross revenue per hectare is reduced beyond 1,000 pesos from the basic value, no rice enters the optimal enterprise organization.