332.11072

DOCUMENTO DE TRABAJO
Working Document Series

Division de Analisis Sectorial
Oficina de Asuntos
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PN-AAN-496/62
ISN-31619

AGRICULTURE

ANALYTICAL WORKING DOCUMENT # 9

LINEAR PROGRAMMING ANALYSIS OF THE IMPACT OF CREDIT ON SMALL FARM PRODUCTION, IMPUTS AND PROFITS

James Doster
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April 1973

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INTRODUCTION

Background

The present paper describes the effect of capital and credit on a small, representative Colombian farm. Data were obtained from eight farms in the region of Cundinamaraca.

Within Cundinamarca we chose farmers who were growing similar crops with similar inputs and outputs. The level of technology is held constant throughout. Also, within this region crops can be grown year round, so multiple cropping takes place.

Within the present L.P. model our attention is focused on six crops. Of the six crops produced, four take five months to grow, namely, ajo, cebolla, frijol, and remolacha. The two remaining crops arveja and papa, take three and six months respectively.

Nature of the Problem

The problem confronting us has four components. The first is concerned with measuring the impact of liquid capital available at the beginning of the year. The second seeks to measure the impact of access to an open line of credit. The third measures the impact of INCORA credit. In the fourth we want to measure the impact of credit where the farmers have access to both an open line of credit and INCORA credit.

For comparative purposes, in each of the four facets of the problem we will analyze production, profit, wages, interest, and the cost of purchased inputs.

PROCEDURES

General Approach

This section describes the use of linear programming analysis to determine the profit maximization level of output of agricultural crops.

The analysis is restricted solely to short cycle crops and does not include livestock or percennial crops.

The mathematical symbols used in constructing our linear programming model, are:

A_o = Liquid assets at the end of previous year.

A_t = Liquid assets at the end of month t.

a_{tj} = Net cash receipts for production activity j in month t without INCORA credit.

c_{tj} = Net cash receipts for production activity j in month t with INCORA credit.

b = Cost of a unit of labor (20 pesos per unit).

H_t = Household expenses during month t.

X_j = The level of production activity j, without INCORA credit.

Z_j = The level of production activity j with INCORA credit.

Y_t = The amount of labor hired in month t.

I_t = Credit balance in open line of credit in month t.

The Linear Programming Model

There are a total of 38 crop production activities represented in the model, 19 for production without INCORA and 19 for production with INCORA credit. Each activity refers to the production of one of 6 agricultural commodities. In every case each commodity is represented in at least three activities.

Linear programming techniques are used to select that level of production for each activity which maximizes the objective function subject to limited resource restrictions.

The monthly labor constraints (L1 through L12), can be found in Appendix A. The same is true of monthly land constraints (A1 through A12). Asset balance equations (B1 through B12) are also formulated on a monthly basis. It is assumed that there is a lower limit for assets (500 pesos), represented by rows (C1 through C12). Again all equations relating to assets can be found in the L.P. matrix in Appendix A.

It is assumed that the first 100 days of labor in any month would be performed by family members. However, additional units of labor can be hired at the rate of 20 pesos per day, provided the funds are available. Crop land in each month is limited to 3.075 hectares.

In order to obtain results under the no credit available program, we delete the open line of credit and INCORA activities for that particular run. In obtaining the results of the open line of credit program we delete the INCORA activities for that particular fun. The results from the INCORA credit program are obtained by deleting the open line of credit activities for that run. The results when both an open line of credit and INCORA credit are available, are obtained by including all activities

for that particular run. Thus there are a total of four credit situations; however, there are eight runs since each situation is run with both a low and a high initial capital figure.

Activities

The 38 production activities are defined in the Table A1. Of these, 19 refer to production with INCORA credit and 19 refer to production without INCORA credit. Five commodities are produced by six activities each, while the sixth commodity is produced by eight activities.

In addition there are 12 labor hiring activities, one for each month, and 12 asset activities which refer to the end of the month level of liquid assets.

Labor Constraints

There is one labor constraint for each month, which states that the total labor used by the crop activities cannot exceed available family labor in that month plus hired labor. The coefficients appear in rows L1-L12 in the L.P. matrix in Appendix A. Monthly labor requirements were estimated for each activity based on the patrons for Cundinamarca. The sample data for the eight farms revealed that, on the average, four family members were available for work; we assumed that the average family member would be available for work 25 days per month.

Land Constraints

The sample revealed that the average farm had 3.075 hectares of land available each month for crop activities. Since all crop activities are defined in one hectare units in the program, all crop activities have coefficients of one in their respective land constraint rows. The land constraints and coefficients are located in rows A1 through A 12 in the linear programming matrix in Appendix A.

Capital Constraints

The capital constraints link the level of liquid assets at the end of the month with the level at the end of the previous month. Thus, the first equation states that liquid assets at the end of January equals assets at the end of the previous year (or, equivalently, the beginning of January) plus net cash receipts from the crop activities minus wages paid plus the amount borrowed from the line of credit minus household expenditures.

$$\sum_j a_{1j}X_j + \sum_j c_{1j} Z_j - bY_1 + I_1 - A_1 = H_1 - A_o$$

Household expenditures are fixed at 641 pesos per month. Likewise, liquid assets at the beginning of the year (A_o) is fixed.

We arrived at the low initial capital figure by assuming that the average farmer had encough liquid assets available to cover average household expenditures for a nine month period. The assumption used to arrive at the high initial capital figure was that liquid assets were available to cover twelve months of household expenditures.

The other eleven capital constraints are similar:

$$\sum_j a_{tj}X_j + \sum_j c_{tj} Z_j - bY_t + I_t - (1.02)I_{t-1} - A_t + A_{t-1} = H_t$$

where $t = 2,3,\ldots,12$

These equations include a term for repayment of principal and interest on the loan extended in the previous month. Note that the a and c coefficients refer to cash flows. Thus the a coefficients are zero or negative except for the month of harvest when it is assumed the crop is sold. The c coefficients are the same as the a coefficients except for the flow of funds from the INCORA loans, which are tied to the particular crops. It is assumed that the proceeds of the INCORA loan are received in the month the crop is planted and that the principal and interest are paid out of the sales revenue in the month the crop is harvested.

Finally, there are twelve restrictions which put a lower limit on the levels of liquid assets:

$$A_t \geq 500, \quad t=1,2,\ldots,12$$

Objective Function

The objective is maximization of profit. defined as cash receipts minus eash outlays. Thus, the profit for each of the production activities is the algebraic sum of the coefficients in the capital rows for that column. All labor activities have a minus 20 in the objective row, reflecting the cost of one man-day of labor. For each line of credit activities, the entry in the profit row is minus 0.02, which is the interest charge on a loan of one peso.

Results of the Analysis

This section presents the results of the analysis. As was pointed out earlier, we assumed four differenct situations surrounding the various credit programs. The four are as follows: (1) no access to credit, (2) access to an open line of credit, (3) access to INCORA credit, (4) access to both an open line of credit and INCORA credit.

In regard to an open line of credit, it is assumed that the borrower can borrow as much as he needs at 2 percent per month. It is felt that this rate is comparable to the rates of the various commercial lending institutions in a position to make such loans.

On the other hand INCORA credit was made available to the borrower at an annual interest rate of 11 percent. 1/ However, unlike the line of credit, INCORA credit is tied to the production of each crop.

1/ This information was obtained from: James Schwinden and Gerald Feaster, "The INCORA Supervised Credit Program," USAID-Spring Review-Country Program Paper, Colombia, Circulation Draft Copy, October 10, 1972.

Impact of Credit on Profit, Return to Land and Capital, Wages, and Purchased Inputs

The results of solving the model for no credit are presented in column 1 and column 5 of Table 2. Column 1 of Table 2 is the result of solving the model with the low initial capital figure ($5,128). This solution is taken as the benchmark against which all other programs are compared. It should be noted also that data in columns 2,3, and 4 are the solution to the model with low initital capital (5128 pesos); while data in columns 5,6, 7 and 8 in Table 2 are the solutions to the model with high initial capital ($7,051).

It is interesting to note that while all items being examined increased with the accessibility of credit the greatest gains were for purchased inputs (42 percent); production (35 percent); return to land and capital (30 percent); and profit (28 percent) for both the line of credit and the combination solutions.

Although the INCORA interest rate is lower, the solutions in which the line of credit is available provide greater gains in profit, return to land and capital, production, wages and purchased inputs. This all points to the conclusion that the increase in the use of factor inputs and thus production and profit, is a function more of the accessibility of credit than a lower interest rate.

Impact of Credit on Crops, Number of Hectares, Hired Labor, Interest, Purchased Inputs and Profit

The results of solving the model for no credit available is set out in column 1 and column 5 of Table 1, for both low initial capital ($5128) and high initial capital ($7051); the solution shows that in the no credit case, 3 crops were grown.

By comparison, the line of credit programs and the Combination (columns 2,4,6 and 8 of Table 1) show that only one crop was planted. On the other hand one INCORA program (column 3) calls for planting 3 crops and the other (column 7) calls for 2 crops. Thus, from Table 1, we see that as the credit position of the borrower improves production becomes more specialized; also the number of hectares per crop increases along with production, hired labor, interest, purchased inputs and profits.

Impact of Credit on the Amount of Labor Used

Table 3, columns 1 and 5 give the results of solving the model when no credit is available, for both low and high initial capital. By comparison the total labor employed for the year increases throughout as credit is made available to the borrowers.

Impact of Credit on Interest, Hired Labor, and Family Labor

By way of comparison we can see that when low initial capital is assumed (5128 pesos) INCORA interest cost is 60 percent as much as in the open line of credit program, while the combination program utilized about the same amount. However, when initial capital rises to $7051 pesos interest cost is significantly less for all programs. The interesting thing about hired labor is that the highest level occurred under the no credit program with high initial capital. The figure for family labor remained relatively unchanged for all credit programs.

Impact of Credit on Asset Levels on a Monthly Basis

Table 6, shows the liquid asset balances on a monthly basis throughout the year.

It is interesting to note that in the solutions where assets were near or at their lower limits for a period of 3 months or more profits, return to capital, production, and purchased inputs are at their maximum values.

Table 1. Number of Hectares, Planted by Crop, Value of Production, Hired Labor, Interest, Cost of Purchased Inputs and Profit.

	Low Initial Capital				High Initial Capital			
	No Credit Available	Line of Credit	INCORA	Line of Credit and INCORA	No Credit Available	Line of Credit	INCORA	Line of Credit and INCORA
Crops (Hectares)								
Arveja	2.824		.270		1.974			
Papa	3.075	6.15	5.366	6.150	3.075	6.15	5.594	6.150
Ajo	1.045		.649		1.848		.556	
Value of Prod. (Pesos)	79,219.79	106,599.79	101,628.36	106,599.79	84,951.09	106,599.79	103,634.48	106,599.79
Hired Labor (Pesos)		640.00	240.00	640.00	680.00	640.00	440.00	640.00
Interest (Pesos)		988.45	392.85	395.10 1/		820.31	266.85	279.68 2/
Cost of Purchased Inputs (Pesos)	27,334.54	38,761.29	36,233.13	38,761.29	28,332.55	38,761.29	36,943.02	38,761.29
Profit (Pesos) 3/	52,011.85	66,240.17	65,233.63	66,572 11	55,942.16	66,408.30	65,920.44	66,691.75

1/ $269.10 for line of credit and $126.00 for INCORA loans

2/ $153.68 for line of credit and $126.00 for INCORA loans.

3/ Returns to land, capital and family labor.

Table 2. Value of Production, Hired Labor, Family Labor, Cost of Purchased Inputs and Return to Land and Capital.
(All Entries in PESOS)

	Low Initial Capital				High Initial Capital			
	No Credit Available	Line of Credit	INCORA	Line of Credit and INCORA	No Credit Available	Line of Credit	INCORA	Line of Credit and INCORA
Value of Production	79,219.79	106,599.79	101,628.36	106,599.79	84,951.09	106,599.79	103,634.48	106,599.79
Hired Labor		640.00	240.00	640.00	680.00	640.00	440.00	640.00
Imputed Value of Family Labor 1/	13,840.00	16,400.00	16,700.00	16,400.00	14,820.00	16,400.00	16,660.00	16,400.00
Interest		988.45	392.85	395.10 3/		820.31	266.85	279.68 4/
Cost of Purchased Inputs	27,334.54	38,761.29	36,233.13	38,761.29	28,332.55	38,761.29	36,943.02	38,761.29
Return to Land and Capital 2/	38,045.25	49,810.05	48,062.38	50,393.40	41,118.54	49,978.19	49,324.61	50,518.82

1/ Family labor valued at 20 pesos per day.

2/ Profits as indicated in Table 1 minus inputed value of family labor.

3/ $269.10 for line of credit and $126 for INCORA loans.

4/ $153.68 for line of credit and $ 126 for INCORA loans.

Table 3. Monthly Labor Utilization (Man-Days)

Month	Low Initial Capital				High Initial Capital			
	No Credit Available	Line of Credit	INCORA	Line of Credit and INCORA	No Credit Available	Line of Credit	INCORA	Line of Credit and INCORA
January	38	108	102	108	63	108	106	108
February	38	74	73	74	57	74	74	74
March	37	77	73	77	52	77	74	77
April	36	31	34	31	40	31	31	31
May	98	28	63	28	134	28	56	28
June	43	108	84	108	27	108	88	108
July	95	108	104	108	95	108	108	108
August	66	74	72	74	66	74	74	74
September	82	77	78	77	82	77	77	77
October	28	31	30	31	28	31	31	31
November	31	28	28	28	31	28	28	28
December	100	108	106	108	100	108	108	108
Total	692	852	847	852	775	852	855	852

Table 4. Increases in Profit, Returns to Land and Capital, Production, Wages, and Purchased Inputs due to Changes in Initial Capital and Credit Availability 1/

Increases	Low Initial Capital			High Initial Capital			
	Line of Credit	INCORA	Line of Credit and INCORA	No Credit Available	Line of Credit	INCORA	Line of Credit and INCORA
Profit	14228.32	13221.78	14560.26	3930.31	14396.45	13908.59	14699.90
Return to Land & Capital	11764.80	10017.13	12545.15	3073.29	11932.94	11279.36	12473.57
Value of Production	27380.00	22408.57	27380.00	5731.30	27380.00	24414.69	27380.00
Wages 2/	3200.00	3100.00	3200.00	1660.00	3200.00	3260.00	3200.00
Purchased Inputs	11426.75	8898.59	11426.75	998.01	11426.75	9608.48	11426.75

1/ All entries are changes from the benchmark solution of low initial capital and no credit availability.
2/ Hired Labor costs plus imputed value of family labor.

Table 5. Percent Increase in Profit, Returns to Land and Capital, Production, Wages, and Purchased Inputs, due to Changes in Initial Capital and Credit Availability 1/

Percent Increase in:	Low Initial Capital			High Initial Capital			
	Line of Credit	INCORA	Line of Credit and INCORA	No Credit Available	Line of Credit	INCORA	Line of Credit and INCORA
Profit	27.4	25.4	27.9	7.6	27.7	26.7	28.2
Return to Land & Capital	30.9	26.3	32.7	8.0	31.4	29.6	32.7
Value of Production	34.56	28.28	34.56	7.23	34.56	30.81	34.56
Wages 2/	23.12	22.4	23.12	12	23.12	24	23.12
Purchased Inputs	41.8	32.5	41.8	3.6	41.8	35	41.8

1/ All entries are changes from the benchmark solution of low initial capital and no credit availability.

2/ Hired labor costs plus imputed value of family labor.

Table 6. End of the Month Liquid Assets

Month	Low Initial Capital				High Initial Capital			
	No Credit Available	Line of Credit	INCORA	Line of Credit and INCORA	No Credit Available	Line of Credit	INCORA	Line of Credit and INCORA
January	3351.15	500.00	9462.06	8665.50	4429.40	1978.50	10616.60	10494.49
February	500.00	500.00	2058.86	500.00	500.00	500.00	2899.65	2165.99
March	3675.70	500.00	1303.36	500.00	3444.60	500.00	1418.96	500.00
April	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
May	9709.34	500.00	500.00	500.00	19414.40	500.00	500.00	500.00
June	16199.52	34548.80	32814.77	34880.80	22052.82	36639.94	36152.13	36923.44
July	11451.85	28835.30	27385.20	29167.30	17305.16	30926.44	30438.63	31209.94
August	3443.95	20506.80	19141.98	20838.80	9297.26	22597.94	22110.13	22881.44
September	10758.49	18840.80	19469.08	19172.81	16611.80	20931.95	20444.14	21215.45
October	9716.93	18199.80	18721.54	18531.81	15510.24	20290.95	19803.14	20574.45
November	3800.98	11810.65	12458.25	12142.65	9654.29	13901.78	13413.98	14185.29
December	50088.78	64317.04	63310.57	64649.05	55942.08	66408.18	65920.38	66691.69

Implications for Credit Policy

Although the model is a general one which can be applied to a wide range of farm situations, this study is limited to one area in Cundinamarca. Thus, at the present time, implications of this study are only suggestive of possible general relationships in the Colombian Agriculture Sector. Generalizations applicable to the entire sector may, however, be derived at a later date when more farm level studies become available.

The results support several interesting hypotheses about the impact of credit. First, credit, whether subsidized or not, has a dramatic impact on the mix of crops produced. When adequate credit is available, there is more specialization in the most profitable crop (in this case, papa).

Second, credit availability leads to large increases in the use of purchased inputs. The value of production increases about two or three times the increase in purchased inputs. Thus, returns to the factors of production (land, labor and capital) increase somewhat more than the increase in the cost of purchased inputs.

Third, although the availability of credit leads to quite large increases in the use of family labor, the impact on hired labor is relatively small. In fact, since the greatest use of hired labor occurs in a program in which no credit is available, one might even question whether credit has any positive impact on hired labor.

Fourth, if the farmer can borrow at the market rate of interest, the availability of credit through a subsidized program such as INCORA has very little impact on farm operations. This is clearly illustrated in Table 1 when a situation where only the line of credit is available is compared to that where both the line of credit and INCORA loans are available. Production, hired labor and purchased inputs are exactly the same. The only differences are interest payments and corresponding changes in profits.

APPENDIX

Table A1 defines the 38 crop production activities. This is followed by a "Picture" of the linear programming matrix. Finally, the printout of the matrix is presented.

Table A 1. Definition of Crop Activities

Code				
Regular Crops	INCORA Crops	Crops	Planting Month	Harvesting Month
ARV 1	I ARV 1	Arveja	January	March
ARV 2	I ARV 2	Arveja	April	June
ARV 3	I ARV 3	Arveja	July	September
ARV 4	I ARV 4	Arveja	October	December
CEB 1	I CEB 1	Cebolla	January	May
CEB 2	I CEB 2	Cebolla	April	August
CEB 3	I CEB 3	Cebolla	September	January
PAP 1	I PAP 1	Papa	January	June
PAP 2	I PAP 2	Papa	April	September
PAP 3	I PAP 3	Papa	July	December
AJO 1	I AJO 1	Ajo	January	May
AJO 2	I AJO 2	Ajo	April	August
AJO 3	I AJO 3	Ajo	July	November
FRI 1	I FRI 1	Frijol	January	May
FRI 2	I FRI 2	Frijol	May	September
FRI 3	I FRI 3	Frijol	August	December
REM 1	I REM 1	Remolacha	January	May
REM 2	I REM 2	Remolacha	May	September
REM 3	I REM 3	Remolacha	July	December

		AR V1	AP V2	AN V3	AP V4	CE R1	CE H2	CE B3	PA P1	PA P2	PA P3	AA J0 1	AA J0 2	AA J0 3	FR I1	FR I2	FR I3	RE M1	PE M2	PE M3	HI PE 1	HI PR 2	HI PR 3	HI PE 4	HI PR 5	HI PE 6	HI PE 7	HI PE 8	HI PR 9	HI RE 10	HI RE 11	HI RE 12	AS SE 1	AS SE 2	AS SE 3	AS SE 4	AS SE 5	AS SE 6	AS SE 7	AS SE 8	AS SE 9	AS SE 10	AS SE 11	AS SE 12	LI CC 1	LI CC 2	LI CC 3	LI CC 4	LI CC 5	LI CC 6	LI CC 7	LI CC 8	LI CC 9	LI CC 10	LI CC 11	LI CC 12
L1	L	A				B			B			B			A			A			-1																																			
L2	L	B				C			B			B			A			B				-1																																		
L3	L	B				B			B			B			A			B					-1																																	
L4	L		A			B	B		A	B		A	B		A			B						-1																															
L5	L		B			B	C		A	B		B	B		A	A		B	A						-1																													
L6	L		B				B		B	B			B			A			B							-1																													
L7	L			A			B	B		A	B		A	B		A			B								-1																												
L8	L			B			B	C		A	B		B	B		A	A		B	A								-1																											
L9	L			B				B		B	B			B		A	A		B	B									-1																										
L10	L				A			B			A			A			A			B										-1																									
L11	L				B			B			A			B			A			B											-1																								
L12	L				B						B						A			B												-1																							
A1	L	1				1			1			1			1			1																																					
A2	L	1				1			1			1			1			1																																					
A3	L	1				1			1			1			1			1																																					
A4	L		1			1	1		1	1		1	1		1			1																																					
A5	L		1			1	1		1	1		1	1		1	1		1	1																																				
A6	L		1				1		1	1			1			1			1																																					
A7	L			1			1	1		1	1		1	1		1			1																																					
A8	L			1			1	1		1	1		1	1		1	1		1	1																																				
A9	L			1				1		1	1			1		1	1		1	1																																					
A10	L				1			1			1			1			1			1																																				
A11	L				1			1			1			1			1			1																																				
A12	L				1						1						1			1																																				
B1	E	-C				-D			-D			-D			-C			-D			-B												-1													1										
B2	E	-C				-D			-D			-D			-C			-D				-B												1-1													-A	1									
B3	E	D							-C														-B												1-1													-A	1								
B4	E		-C			-C-D				-D		-C-D			-C			-D						-B												1-1													-A	1							
B5	E		-C			E-D			-D-D			E-D			D-C			E-D							-B												1-1													-A	1						
B6	E		D						E-C						-C			-D								-B												1-1													-A	1					
B7	E			-C			-C-D			-D		-C-D															-B												1-1													-A	1			
B8	E			-C			E-D		-D-D			E-D			-C-C			-D-D										-B												1-1													-A	1		
B9	E			D					E-C						D-C			E-D											-B													1-1													-A	1	
B10	E				-C			-C					-C																	-B														1-1												-A	1
B11	E				-C			E			-D			E			-C			-D											-B														1-1											-A	1
B12	E				D						E						D			D												-B														1-1											-A	1
C1	G																																	1																							
C2	G																																		1																						
C3	G																																			1																					
C4	G																																				1																				
C5	G																																					1																			
C6	G																																						1																		
C7	G																																							1																	
C8	G																																								1																
C9	G																																									1															
C10	G																																										1													
C11	G																																											1											

		IARV1	IARV2	IARV3	IARV4	ICEB1	ICEB2	ICEB3	IPAP1	IPAP2	IPAP3	IAJO1	IAJO2	IAJO3	IFRI1	IFRI2	IFRI3	IREM1	IREM2	IREM3	R68
L1	L	A				B			A			A			A			A			B
L2	L	B				C			B			B			A			B			B
L3	L	B				E			A			A			A			A			B
L4	L		A			A	B		A	B		A	B		A			B			B
L5	L		A			B	C		B	A		B	B		A	A		B	A		B
L6	L		B				B		A	B			B			A			A		B
L7	L			A			B	A		A	B		A	B		A			A		B
L8	L			B			B	C		A	A		B	B		A	A		B	A	B
L9	L			B				E		B	B			B		A	A		B	B	B
L10	L				A			A			A			A			A			B	B
L11	L				B			B			A			B			A			B	B
L12	L				B						B						A			B	B
A1	L	1				1			1			1			1			1			A
A2	L	1				1			1			1			1			1			A
A3	L	1				1			1			1			1			1			A
A4	L		1			1	1		1	1		1	1		1			1			A
A5	L		1			1	1		1	1		1	1		1	1		1	1		A
A6	L		1				1		1	1			1			1			1		A
A7	L			1			1	1		1	1		1	1		1			1		A
A8	L			1			1	1		1	1		1	1		1	1		1	1	A
A9	L			1				1		1	1			1		1	1		1	1	A
A10	L				1			1			1			1			1			1	A
A11	L				1			1			1			1			1			1	A
A12	L				1						1						1			1	A
B1	E	C				C			D			D			D			D			-D
B2	E	-C				-D			-D			-D			-C			-D			C
B3	E	D							-C												C
B4	E		C			-C	C			D		-C	D		-C			-D			C
B5	E		-C			D-D			-D-D			D-D			D	D		D	D		C
B6	E		D						E-C						-C			-D			C
B7	E			C			-C	C			D		-C	D							C
B8	E			-C			D-C			-D-D			D-D			-C	D		-D	D	C
B9	E			D						E-C						D-C			D-D		C
B10	E				C			-C						-C							C
B11	E				-C			D			-D			D			-C			-D	C
B12	E				D						E						D			D	C
C1	G																				C
C2	G																				C
C3	G																				C
C4	G																				C
C5	G																				C
C6	G																				C
C7	G																				C
C8	G																				C
C9	G																				C
C10	G																				C
C11	G																				C

| | | |

2. 2

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          I I I I I I I I I I I I I I I I I I
          A A A A C C C P P P A A A F F F R R R
          R R R R E F E A A A J J J R R R E E E R
          V V V V B B B P P P G O O I I I M M M 6
          1 2 3 4 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 8

C12     G                                       C
P       N  D D D D D D D E E E D D D D D D D D D
```

CROP PROGRAMMING

SUMMARY OF MATRIX

SYMBOL	RANGE			COUNT (INCL.RHS)
Z	LESS THAN		.000001	
Y	.000001	THRU	.000009	
X	.000010		.000099	
W	.000100		.000999	
V	.001000		.009999	
U	.010000		.099999	12
T	.100000		.999999	
I	1.000000		1.000000	239
A	1.000001		10.000000	85
B	10.000001		100.000000	148
C	100.000001		1,000.000000	81
D	1,000.000001		10,000.000000	117
E	10,000.000001		100,000.000000	20
F	100,000.000001		1,000,000.000000	
G	GREATER THAN		1,000,000.000000	

CROP PROGRAMMING

SUMMARY OF MATRIX

SYMBOL	RANGE			COUNT (INCL.RHS)
Z	LESS THAN		.000001	
Y	.000001	THRU	.000009	
X	.000010		.000099	
W	.000100		.000999	
V	.001000		.009999	
U	.010000		.099999	12
T	.100000		.999999	
I	1.000000		1.000000	239
A	1.000001		10.000000	85
B	10.000001		100.000000	148
C	-100.000001		1,000.000000	81
D	1,000.000001		10,000.000000	117
E	10,000.000001		100,000.000000	20
F	100,000.000001		1,000,000.000000	
G	GREATER THAN		1,000,000.000000	

Best Available Document

CROP PROGRAMMING

	ARV1	ARV2	ARV3	ARV4	CEB1	CEB2	CEB3	
L1	5.00000	.	.	.	50.00000	.	.	L1
L2	15.00000	.	.	.	120.00000	.	.	L2
L3	20.00000	.	.	.	26.00000	.	.	L3
L4	.	5.00000	.	.	29.00000	50.00000	.	L4
L5	.	15.00000	.	.	23.00000	120.00000	.	L5
L6	.	20.00000	.	.	.	26.00000	.	L6
L7	.	.	5.00000	.	.	29.00000	50.00000	L7
L8	.	.	15.00000	.	.	23.00000	120.00000	L8
L9	.	.	20.00000	.	.	.	26.00000	L9
L10	.	.	.	5.00000	.	.	29.00000	L10
L11	.	.	.	15.00000	.	.	23.00000	L11
L12	.	.	.	20.00000	.	.	.	L12
A1	1.00000	.	.	.	1.00000	.	.	A1
A2	1.00000	.	.	.	1.00000	.	.	A2
A3	1.00000	.	.	.	1.00000	.	.	A3
A4	.	1.00000	.	.	1.00000	1.00000	.	A4
A5	.	1.00000	.	.	1.00000	1.00000	.	A5
A6	.	1.00000	.	.	.	1.00000	.	A6
A7	.	.	1.00000	.	.	1.00000	1.00000	A7
A8	.	.	1.00000	.	.	1.00000	1.00000	A8
A9	.	.	1.00000	.	.	.	1.00000	A9
A10	.	.	.	1.00000	.	.	1.00000	A10
A11	.	.	.	1.00000	.	.	1.00000	A11
A12	.	.	.	1.00000	.	.	.	A12
B1	788.00000-	.	.	.	2465.9700-	.	.	B1
B2	938.40000-	.	.	.	2637.7000-	.	.	B2
B3	4800.0000	.	.	.	.	.	.	B3
B4	.	788.00000-	.	.	862.82000-	2465.9700-	.	B4
B5	.	938.40000-	.	.	13382.200	2637.7000-	.	B5
B6	.	4800.0000	.	.	.	.	.	B6
B7	.	.	788.00000-	.	.	862.82000-	2465.9700-	B7
B8	.	.	938.40000-	.	.	13382.200	2637.7000-	B8
B9	.	.	4800.0000	.	.	.	.	B9
B10	.	.	.	788.00000-	.	.	862.82000-	B10
B11	.	.	.	938.40000-	.	.	13382.200	B11
B12	.	.	.	4800.0000	.	.	.	B12
P	3073.6000	3073.6000	3073.6000	3073.6000	7416.7100	7416.7100	7416.7100	P

CROP PROGRAMMING

	PAP1	PAP2	PAP3	AJO1	AJO2	AJO3	FRI1	
L1	35.00000	.	.	32.00000	.	.	7.00000	L1
L2	24.00000	.	.	25.00000	.	.	6.00000	L2
L3	25.00000	.	.	20.00000	.	.	8.00000	L3
L4	10.00000	35.00000	.	10.00000	32.00000	.	5.00000	L4
L5	9.00000	24.00000	.	60.00000	25.00000	.	4.00000	L5
L6	35.00000	25.00000	.	.	20.00000	.	.	L6
L7	.	10.00000	35.00000	.	10.00000	32.00000	.	L7
L8	.	9.00000	24.00000	.	60.00000	25.00000	.	L8
L9	.	35.00000	25.00000	.	.	20.00000	.	L9
L10	.	.	10.00000	.	.	10.00000	.	L10
L11	.	.	9.00000	.	.	60.00000	.	L11
L12	.	.	35.00000	.	.	.	.	L12
A1	1.00000	.	.	1.00000	.	.	1.00000	A1
A2	1.00000	.	.	1.00000	.	.	1.00000	A2
A3	1.00000	.	.	1.00000	.	.	1.00000	A3
A4	1.00000	1.00000	.	1.00000	1.00000	.	1.00000	A4
A5	1.00000	1.00000	.	1.00000	1.00000	.	1.00000	A5
A6	1.00000	1.00000	.	.	1.00000	.	.	A6
A7	.	1.00000	1.00000	.	1.00000	1.00000	.	A7
A8	.	1.00000	1.00000	.	1.00000	1.00000	.	A8
A9	.	1.00000	1.00000	.	.	1.00000	.	A9
A10	.	.	1.00000	.	.	1.00000	.	A10
A11	.	.	1.00000	.	.	1.00000	.	A11
A12	.	.	1.00000	.	.	.	.	A12
B1	1600.0000-	.	.	1100.0000-	.	.	840.00000-	B1
B2	2500.0000-	.	.	1400.0000-	.	.	900.00000-	B2
B3	333.33000-	.	.	.	.	.	.	B3
B4	.	1600.0000-	.	500.00000-	1100.0000-	.	300.00000-	B4
B5	1869.3200-	2500.0000-	.	12000.000	1400.0000-	.	7500.0000	B5
B6	17333.300	333.33000-	.	.	.	.	.	B6
B7	.	.	1600.0000-	.	500.00000-	1100.0000-	.	B7
B8	.	1869.3200-	2500.0000-	.	12000.000	1400.0000-	.	B8
B9	.	17333.300	333.33000-	.	.	.	.	B9
B10	.	.	.	.	.	500.00000-	.	B10
B11	.	.	1869.3200-	.	.	12000.000	.	B11
B12	.	.	17333.300	.	.	.	.	B12
P	11030.670	11030.670	11030.670	9000.0000	9000.0000	9000.0000	5460.0000	P

CROP PROGRAMMING

	FRI2	FRI3	REM1	REM2	REM3	MINE1	MINE2	
L1	.	.	5.00000	.	.	1.00000-	.	L1
L2	.	.	23.00000	.	.	.	1.00000-	L2
L3	.	.	35.00000	.	.	.	.	L3
L4	.	.	25.00000	.	.	.	.	L4
L5	7.00000	.	25.00000	5.00000	.	.	.	L5
L6	6.00000	.	.	23.00000	.	.	.	L6
L7	8.00000	.	.	35.00000	.	.	.	L7
L8	5.00000	7.00000	.	25.00000	5.00000	.	.	L8
L9	4.00000	6.00000	.	25.00000	23.00000	.	.	L9
L10	.	8.00000	.	.	35.00000	.	.	L10
L11	.	5.00000	.	.	25.00000	.	.	L11
L12	.	4.00000	.	.	25.00000	.	.	L12
A1	.	.	1.00000	.	.	.	.	A1
A2	.	.	1.00000	.	.	.	.	A2
A3	.	.	1.00000	.	.	.	.	A3
A4	.	.	1.00000	.	.	.	.	A4
A5	1.00000	.	1.00000	1.00000	.	.	.	A5
A6	1.00000	.	.	1.00000	.	.	.	A6
A7	1.00000	.	.	1.00000	.	.	.	A7
A8	1.00000	1.00000	.	1.00000	1.00000	.	.	A8
A9	1.00000	1.00000	.	1.00000	1.00000	.	.	A9
A10	.	1.00000	.	.	1.00000	.	.	A10
A11	.	1.00000	.	.	1.00000	.	.	A11
A12	.	1.00000	.	.	1.00000	.	.	A12
B1	.	.	1466.6600-	.	.	20.00000-	.	B1
B2	.	.	2013.3300-	.	.	.	20.00000-	B2
B4	.	.	1013.3200-	.	.	.	.	B4
B5	840.00000-	.	12000.000	1466.6600-	.	.	.	B5
B6	900.00000-	.	.	2013.3300-	.	.	.	B6
B8	300.00000-	840.00000-	.	1013.3200-	1466.6600-	.	.	B8
B9	7500.0000	900.00000-	.	12000.000	2013.3300-	.	.	B9
B11	.	300.00000-	.	.	1013.3200-	.	.	B11
B12	.	7500.0000	.	.	1200.0000	.	.	B12
P	5460.0000	5460.0000	7506.6700	7506.6700	7506.6700	20.00000-	20.00000-	P

CROP PROGRAMMING

	HIRE3	HIRE4	HIRE5	HIRE6	HIRE7	HIRE8	HIRE9	
L3	1.00000-	.	.	.	.	.	.	L3
L4	.	1.00000-	.	.	.	.	.	L4
L5	.	.	1.00000-	.	.	.	.	L5
L6	.	.	.	1.00000-	.	.	.	L6
L7	.	.	.	.	1.00000-	.	.	L7
L8	.	.	.	.	.	1.00000-	.	L8
L9	.	.	.	.	.	.	1.00000-	L9
B3	20.00000-	.	.	.	.	.	.	B3
B4	.	20.00000-	.	.	.	.	.	B4
B5	.	.	20.00000-	.	.	.	.	B5
B6	.	.	.	20.00000-	.	.	.	B6
B7	.	.	.	.	20.00000-	.	.	B7
B8	.	.	.	.	.	20.00000-	.	B8
B9	.	.	.	.	.	.	20.00000-	B9
P	20.00000-	20.00000-	20.00000-	20.00000-	20.00000-	20.00000-	20.00000-	P

CROP PROGRAMMING

	HIRE10	HIRE11	HIRE12	ASSET1	ASSET2	ASSET3	ASSET4	
L10	1.00000-	.	.	.	.	.	.	L10
L11	.	1.00000-	.	.	.	.	.	L11
L12	.	.	1.00000-	.	.	.	.	L12
B1	.	.	.	1.00000-	.	.	.	B1
B2	.	.	.	1.00000	1.00000-	.	.	B2
B3	.	.	.	.	1.00000	1.00000-	.	B3
B4	.	.	.	.	.	1.00000	1.00000-	B4
B5	.	.	.	.	.	.	1.00000	B5
B10	20.00000-	.	.	.	.	.	.	B10
B11	.	20.00000-	.	.	.	.	.	B11
B12	.	.	20.00000-	.	.	.	.	B12
C1	.	.	.	1.00000	.	.	.	C1
C2	.	.	.	.	1.00000	.	.	C2
C3	.	.	.	.	.	1.00000	.	C3
C4	.	.	.	.	.	.	1.00000	C4
P	20.00000-	20.00000-	20.00000-	.	.	.	.	P

CROP PROGRAMMING

	ASSET5	ASSET6	ASSET7	ASSET8	ASSET9	ASSET10	ASSET11	
B5	1.00000-	.	.	.	.	.	.	B5
B6	1.00000	1.00000-	.	.	.	.	.	B6
B7	.	1.00000	1.00000-	.	.	.	.	B7
B8	.	.	1.00000	1.00000-	.	.	.	B8
B9	.	.	.	1.00000	1.00000-	.	.	B9
B10	.	.	.	.	1.00000	1.00000-	.	B10
B11	.	.	.	.	.	1.00000	1.00000-	B11
B12	.	.	.	.	.	.	1.00000	B12
C5	1.00000	.	.	.	.	.	.	C5
C6	.	1.00000	.	.	.	.	.	C6
C7	.	.	1.00000	.	.	.	.	C7
C8	.	.	.	1.00000	.	.	.	C8
C9	.	.	.	.	1.00000	.	.	C9
C10	.	.	.	.	.	1.00000	.	C10
C11	.	.	.	.	.	.	1.00000	C11

CROP PROGRAMMING

	ASSET12	LIC1	LIC2	LIC3	LIC4	LIC5	LIC6	
B1	.	1.00000	.	.	.	.	.	B1
B2	.	1.02000-	1.00000	.	.	.	.	B2
B3	.	.	1.02000-	1.00000	.	.	.	B3
B4	.	.	.	1.02000-	1.00000	.	.	B4
B5	.	.	.	.	1.02000-	1.00000	.	B5
B6	.	.	.	.	.	1.02000-	1.00000	B6
B7	.	.	.	.	.	.	1.02000-	B7
B12	1.00000-	.	.	.	.	.	.	B12
C12	1.00000	.	.	.	.	.	.	C12
P	.	.02000-	.02000-	.02000-	.02000-	.02000-	.02000-	P

CROP PROGRAMMING

	LIC7	LIC8	LIC9	LIC10	LIC11	LIC12	IARV1	
L1	.	.	.	.	.	.	5.00000	L1
L2	.	.	.	.	.	.	15.00000	L2
L3	.	.	.	.	.	.	20.00000	L3
A1	.	.	.	.	.	.	1.00000	A1
A2	.	.	.	.	.	.	1.00000	A2
A3	.	.	.	.	.	.	1.00000	A3
B1	.	.	.	.	.	.	725.06000	B1
B2	.	.	.	.	.	.	938.40000-	B2
B3	.	.	.	.	.	.	3252.9000	B3
B7	1.00000	.	.	.	.	.	.	B7
B8	1.02000-	1.00000	.	.	.	.	.	B8
B9	.	1.02000-	1.00000	.	.	.	.	B9
B10	.	.	1.02000-	1.00000	.	.	.	B10
B11	.	.	.	1.02000-	1.00000	.	.	B11
B12	.	.	.	.	1.02000-	1.00000	.	B12
P	.02000-	.02000-	.02000-	.02000-	.02000-	.02000-	3039.5600	P

CROP PROGRAMMING

	IARV2	IARV3	IARV4	ICEB1	ICEB2	ICEB3	IPAP1	
L1	.	.	.	50.00000	.	.	35.00000	L1
L2	.	.	.	120.00000	.	.	24.00000	L2
L3	.	.	.	26.00000	.	.	25.00000	L3
L4	5.00000	.	.	29.00000	50.00000	.	10.00000	L4
L5	15.00000	.	.	23.00000	120.00000	.	9.00000	L5
L6	20.00000	.	.	.	26.00000	.	35.00000	L6
L7	.	5.00000	.	.	29.00000	50.00000	.	L7
L8	.	15.00000	.	.	23.00000	120.00000	.	L8
L9	.	20.00000	.	.	.	26.00000	.	L9
L10	.	.	5.00000	.	.	25.00000	.	L10
L11	.	.	15.00000	.	.	23.00000	.	L11
L12	.	.	20.00000	.	.	.	.	L12
A1	.	.	.	1.00000	.	.	1.00000	A1
A2	.	.	.	1.00000	.	.	1.00000	A2
A3	.	.	.	1.00000	.	.	1.00000	A3
A4	1.00000	.	.	1.00000	1.00000	.	1.00000	A4
A5	1.00000	.	.	1.00000	1.00000	.	1.00000	A5
A6	1.00000	.	.	.	1.00000	.	1.00000 -	A6
A7	.	1.00000	.	.	1.00000	1.00000	.	A7
A8	.	1.00000	.	.	1.00000	1.00000	.	A8
A9	.	1.00000	.	.	.	1.00000	.	A9
A10	.	.	1.00000	.	.	1.00000	.	A10
A11	.	.	1.00000	.	.	1.00000	.	A11
A12	.	.	1.00000	.	.	.	.	A12
B1	.	.	.	977.72000	.	.	1200.0000	B1
B2	.	.	.	2637.7000-	.	.	2500.0000-	B2
B3	.	.	.	.	.	.	333.33000-	B3
B4	725.06000	.	.	862.82000-	977.72000	.	.	B4
B5	938.40000-	.	.	9809.3700	2637.7000-	.	1869.3200-	B5
B6	3252.9000	.	.	.	.	.	14407.330	B6
B7	.	725.06000	.	.	862.82000-	977.72000	.	B7
B8	.	938.40000-	.	.	9809.3700	2637.7000-	.	B8
B9	.	3252.9000	.	.	.	.	.	B9
B10	.	.	725.06000	.	.	862.82000-	.	B10
B11	.	.	938.40000-	.	.	9809.3700	.	B11
B12	.	.	3252.9000	.	.	.	.	B12
P	3039.5600	3039.5600	3039.5600	7287.5700	7287.5700	7287.5700	10904.680	P

CROP PROGRAMMING

	IPAP2	IPAP3	IAJ01	IAJ02	IAJ03	IFRI1	IFRI2	
L1	.	.	32.00000	.	.	7.00000	.	L1
L2	.	.	25.00000	.	.	6.00000	.	L2
L3	.	.	20.00000	.	.	6.00000	.	L3
L4	35.00000	.	10.00000	32.00000	.	5.00000	.	L4
L5	24.00000	.	60.00000	25.00000	.	4.00000	7.00000	L5
L6	25.00000	.	.	20.00000	.	.	6.00000	L6
L7	10.00000	35.00000	.	10.00000	32.00000	.	8.00000	L7
L8	9.00000	24.00000	.	60.00000	25.00000	.	5.00000	L8
L9	35.00000	25.00000	.	.	20.00000	.	4.00000	L9
L10	.	10.00000	.	.	10.00000	.	.	L10
L11	.	9.00000	.	.	60.00000	.	.	L11
L12	.	35.00000	.	.	.	.	.	L12
A1	.	.	1.00000	.	.	1.00000	.	A1
A2	.	.	1.00000	.	.	1.00000	.	A2
A3	.	.	1.00000	.	.	1.00000	.	A3
A4	1.00000	.	1.00000	1.00000	.	1.00000	.	A4
A5	1.00000	.	1.00000	1.00000	.	1.00000	1.00000	A5
A6	1.00000	.	.	1.00000	.	.	1.00000	A6
A7	1.00000	1.00000	.	1.00000	1.00000	.	1.00000	A7
A8	1.00000	1.00000	.	1.00000	1.00000	.	1.00000	A8
A9	1.00000	1.00000	.	.	1.00000	.	1.00000	A9
A10	.	1.00000	.	.	1.00000	.	.	A10
A11	.	1.00000	.	.	1.00000	.	.	A11
A12	.	1.00000	.	.	.	.	.	A12
B1	.	.	2656.0000	.	.	2200.0000	.	B1
B2	.	.	1400.0000-	.	.	900.00000-	.	B2
B4	1200.0000	.	500.00000-	2656.0000	.	300.00000-	.	B4
B5	2500.0000-	.	8103.1500	1400.0000-	.	4346.0000	2200.0000	B5
B6	333.33000-	.	.	.	.	.	500.00000-	B6
B7	.	1200.0000	.	500.00000-	2656.0000	.	.	B7
B8	1869.3200-	2500.0000-	.	8103.1500	1400.0000-	.	300.00000-	B8
B9	14407.330	333.33000-	.	.	.	.	4346.0000	B9
B10	.	.	.	.	500.00000-	.	.	B10
B11	.	1869.3200-	.	.	8103.1500	.	.	B11
B12	.	14407.330	.	.	.	.	.	B12
P	10904.680	10904.680	8859.1500	8859.1500	8859.1500	5346.0000	5346.0000	P

CROP PROGRAMMING

	IFP13	IREM1	IREM2	IREM3	RHS	
L1	.	5.00000	.	.	100.00000	L1
L2	.	23.00000	.	.	100.00000	L2
L3	.	35.00000	.	.	100.00000	L3
L4	.	25.00000	.	.	100.00000	L4
L5	.	25.00000	5.00000	.	100.00000	L5
L6	.	.	23.00000	.	100.00000	L6
L7	.	.	35.00000	.	100.00000	L7
L8	7.00000	.	25.00000	5.00000	100.00000	L8
L9	6.00000	.	25.00000	23.00000	100.00000	L9
L10	8.00000	.	.	35.00000	100.00000	L10
L11	5.00000	.	.	25.00000	100.00000	L11
L12	4.00000	.	.	25.00000	100.00000	L12
A1	.	1.00000	.	.	3.07500	A1
A2	.	1.00000	.	.	3.07500	A2
A3	.	1.00000	.	.	3.07500	A3
A4	.	1.00000	.	.	3.07500	A4
A5	.	1.00000	1.00000	.	3.07500	A5
A6	.	.	1.00000	.	3.07500	A6
A7	.	.	1.00000	.	3.07500	A7
A8	1.00000	.	1.00000	1.00000	3.07500	A8
A9	1.00000	.	1.00000	1.00000	3.07500	A9
A10	1.00000	.	.	1.00000	3.07500	A10
A11	1.00000	.	.	1.00000	3.07500	A11
A12	1.00000	.	.	1.00000	3.07500	A12
B1	.	1200.0000	.	.	7051.0000-	B1
B2	.	2013.3300-	.	.	641.00000	B2
B3	.	.	.	.	641.00000	B3
B4	.	1013.3200-	.	.	641.00000	B4
B5	.	9233.3500	1200.0000	.	641.00000	B5
B6	.	.	2013.3300-	.	641.00000	B6
B7	.	.	.	.	641.00000	B7
B8	2200.0000	.	1013.3200-	1200.0000	641.00000	B8
B9	900.00000-	.	9233.3500	2013.3300-	641.00000	B9
B10	.	.	.	.	641.00000	B10
B11	300.00000-	.	.	1013.3200-	641.00000	B11
B12	4346.0000	.	.	9233.3500	641.00000	B12
C1	.	.	.	.	500.00000	C1
C2	.	.	.	.	500.00000	C2
C3	.	.	.	.	500.00000	C3
C4	.	.	.	.	500.00000	C4
C5	.	.	.	.	500.00000	C5
C6	.	.	.	.	500.00000	C6
C7	.	.	.	.	500.00000	C7
C8	.	.	.	.	500.00000	C8
C9	.	.	.	.	500.00000	C9
C10	.	.	.	.	500.00000	C10
C11	.	.	.	.	500.00000	C11
C12	.	.	.	.	500.00000	C12
P	5346.0000	7406.4800	7406.4800	7406.4800	.	P