

ENERGY SYSTEM OF CACAO IN BAHIA, BRAZIL

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ABSTRACT

An energy systems overview was obtained of the system of cacao production and processing as recommended by CEPEC (Centro de Pesquisas do Cacau). A systems diagram was provided in energy symbol language. The inputs responsible for generating a good yield of dried cacao seeds were evaluated, first in actual energy units (kilocalories). Next embodied solar energy of each pathway was estimated by multiplying actual energy flows by an appropriate energy transformation ratio between sunlight and the flow being evaluated. These results were summarized in a simplified energy systems diagram, and ratios were calculated to compare with other agroecosystems, to determine economic characteristics, and to determine the energy bases for the crop. Finally, a highly aggregated version of the system was programmed for microcomputer simulation, suggesting characteristic responses with time to changes in conditions and inputs.

As new innovations are made in agroecosystems, many questions arise as to costs, benefits, and energy uses. To understand an agroecosystem and its role in the larger economy, an energy systems overview is needed which shows the interactions of the parts and the exchanges with the larger outside system. This paper is a preliminary effort to overview the complex system of growing cacao and processing the seeds that ultimately are used for chocolate products. Data on the many parts of the cacao system are very extensive, but there have been few efforts to examine the system or develop models. In this overview, an energy analysis is made by

evaluating the energy flows on the pathways of the diagram and then putting all the energy values on the same bases by expressing them in energy units of one type, solar energy.

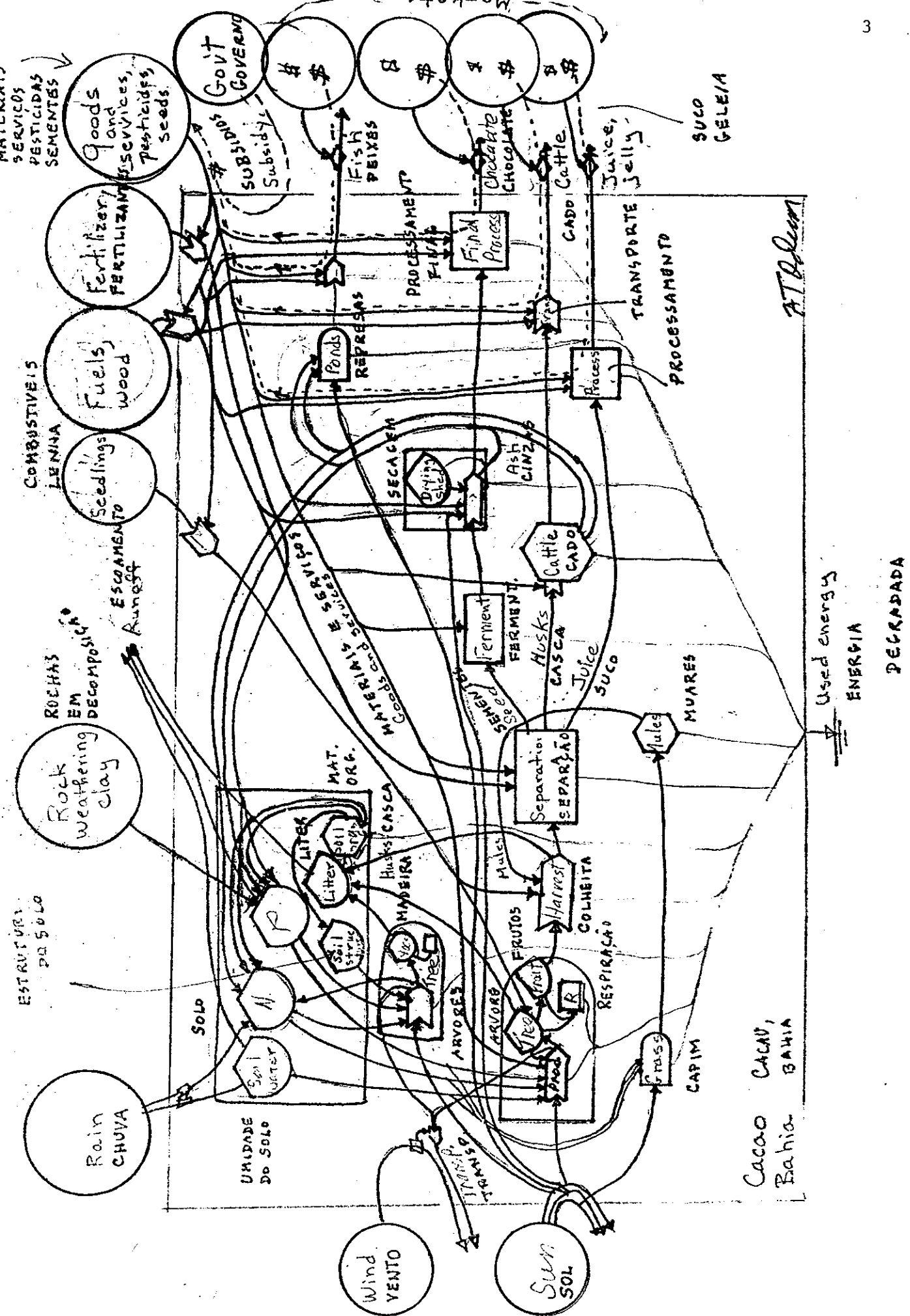
METHODS

Data were assembled with aid of staff of CEPEC. After a systems diagram was drawn to include the main steps of the production and processing of cacao, an energy analysis table was prepared, estimating the actual energy of each flow. Energy Transformation Ratios from other studies were used to express results in embodied solar equivalents. Embodied solar equivalents are the solar calories necessary to generate a flow of energy of another kind. Most energy transformation ratios were derived from energy analyses of other systems (Odum and Odum, 1983). A summary of methods with examples is given in a reprint (Appendix A).

RESULTS

Energy Systems Diagram

A complex energy systems diagram is given in Figure 1 using energy language symbols (Odum, 1971, 1983). Sources of outside inputs are circles arranged from left to right in order of their energy transformation ratio (ETR). Low energy transformation ratios are indicators of low quality energy, high in quantity, dilute and small in unit effect. Items on the right are high quality with high energy transformation ratio and with large unit effect as controls on other flows as they feed back to the left interacting with lower quality flows. The characteristic pattern is found in most systems probably because this design favors maximum production and consumption.



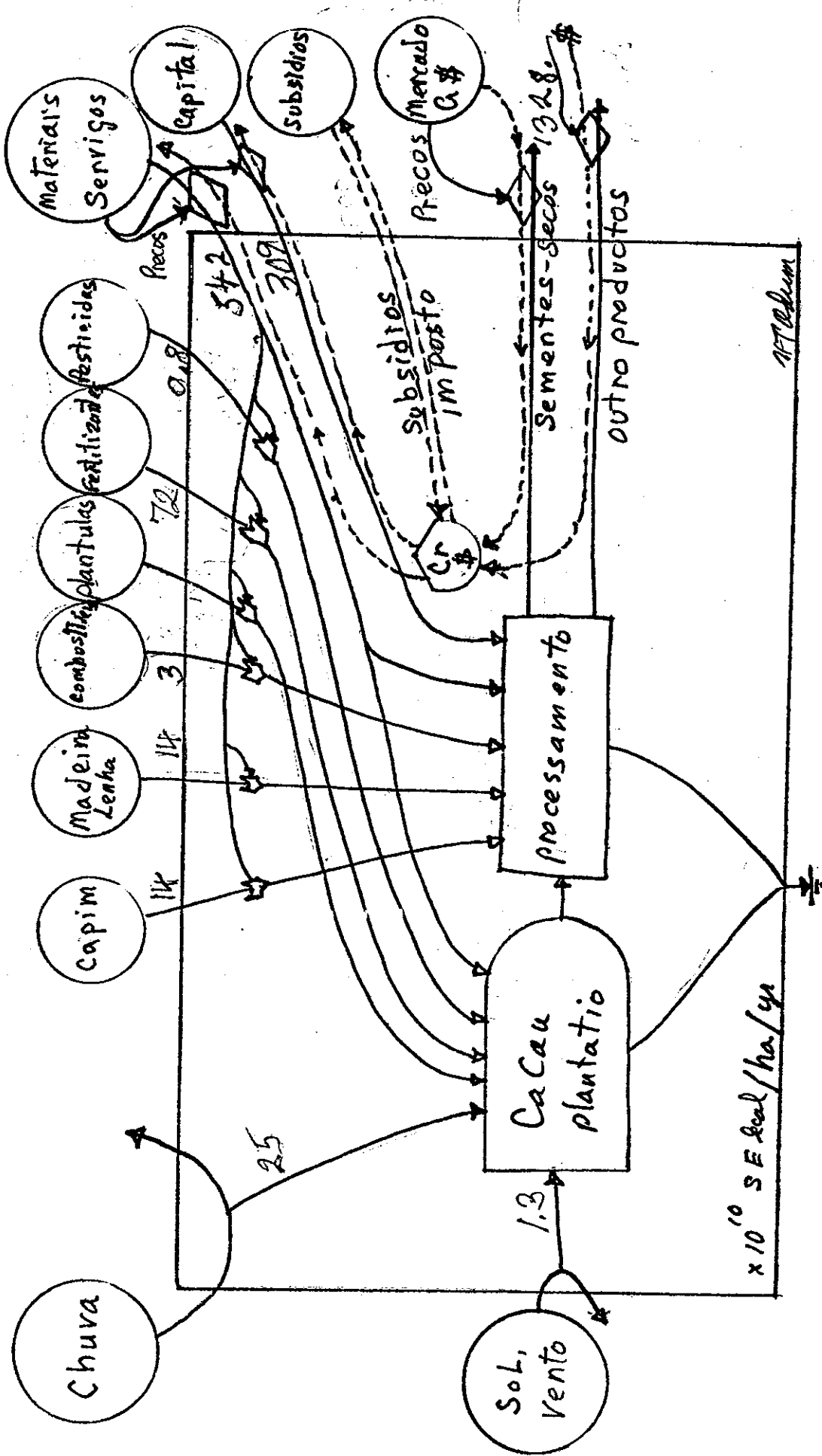
Energy Analysis Table

Energy evaluations of the pathways are given in Table 1, which has calculations in footnotes. The first column of the table has annual flows in various units appropriate for materials, fuels, etc. The actual energy contents of these flows are given in the second column. Most of these are heats of combustion or Gibbs Free Energy changes during use. The third column of the table has energy transformation ratios which are multiplied times the energy flows of column two to obtain embodied solar energy in column four. Some of the energy transformation ratios are per gram of material and multiplied by items in the first column.

For human services with data given in money units, an energy transformation ratio for U.S. dollars of that year was used. This ratio was obtained from an energy analysis of the whole Brazilian economy (Odum and Odum, 1983). It included all environmental energy inputs as well as fuels in ratio to cruzieros for the same year expressed as U.S. \$ at the international exchange rate at that time. A sum of embodied energies used in cacao production and processing as far as dried seed is given at the bottom of the table. Since the embodied energy in transpired rain already represents the global energies of the biosphere that were used, direct solar energy and the input of clay from rock weathering were omitted from the total to avoid double counting items that are byproducts of a common process.

Aggregated Diagram with Embodied Energy Values

The estimates of embodied energy in equivalent solar kilocalories are shown on input pathways in Figure 2. This diagram is more aggregated than Figure 1 and has many processes and pathways aggregated so as to help one visualize the system more easily. The diagram shows dramatically the large



$$\text{Energy Transformation Ratio: } \frac{\text{Solar kilocalories}}{\text{Actual kilocalories}} = \frac{1.93 \text{ E}10}{4.1 \text{ E}6} = 3.3 \text{ E}6$$

Figure 2. Aggregated diagram of system of cacao processing with embodied energy flows written on pathways.

embodied energy in environmental inputs and especially in human services. Because loans have been provided at less than the inflation rate in some years, there have been subsidies which show in the Table 1 and Figure 2 as additional services. The fuel inputs are relatively small and an entirely erroneous view results if only fuels are used in the energy analysis.

Perspectives from Embodied Energy Ratios

In Table 2 are given some ratios calculated from data in Table 1 and Figure 2. The first one is the net energy yield ratio (1.4) which is not really appropriate for a food crop which is not intended to compete as a fuel. Since foreign oil purchased at 1984 prices yields 1.8 times more embodied energy than is embodied in the Brazilian currency paid for the oil, to be competitive as a fuel, the ratio has to be greater than 1.8.

The ratio of the purchased inputs to the free environmental inputs (17.5) is called "investment ratio." It helps to determine whether a system is economic. If the purchased inputs have more embodied energy than competing crops, they may not compete. The investment ratio within Brazil as a whole is about 0.2. So the investment intensity may be too great for domestic consumption.

However, the sale at foreign prices provides a trade benefit ratio of 1.2 (Table 2), and if exchanged for motor fuel at international prices the trade benefit ratio is little better, 1.1.

ACKNOWLEDGMENT

Dr. Paulo de T. Alvim suggested the analysis and provided stimulating discourse. E.S. Freire, H.I.S. Ferreira, and J. Iturbe aided the assembly of data. Work was done at Centro de Pesquisas do Cacau, Itabuna, Bahia, Brazil, August, 1984.

Table 1. Energy flows in cacao, per hectare per year.

| Foot-note | Item | Quantity Various Units | Actual Energy kcal | Energy Transformation Ratio SE kcal/kcal | Embodied Energy SE kcal/g E10 |
|-----------|--|------------------------|--------------------|--|-------------------------------|
| 1. | Solar insolation | -- | 1.258 E10 | 1 | 1.26* |
| 2 | Transpired rain (rain and wind) | 1.35 E10 g | 1.61 E7 | 1.54 E4 | 24.8 |
| 3 | Fertilizer | | | | |
| | Lime (CaJgCO ₃) | 6.75 E5 g | -- | 2.5 E5 SE kcal/g | 16.9 |
| | Nitrogen in urea | 5.72 E4 g | -- | 1.0 E6 SE kcal/g N | 5.7 |
| | Potassium | 3 E4 g | -- | 2.3 E5 SE kcal/g | 0.7 |
| | Phosphorus (super P) | 1 E5 g | -- | 4.8 E6 SE kcal/g | 48. |
| 4 | Clay from weathering | 3.1 E5 g | -- | 4.1 E5 SE kcal/g | 12.7* |
| 5 | Fuels | | | | |
| | Wood | 1024 kg | 4.1 E6 | 3.5 E4 | 14.4 |
| | Motor fuel | 49.8 l | 4.5 E5 | 6.6 E4 | 3.0 |
| | Transport - mules, hay | -- | 4.5 E6 | 3.0 E4 | 13.5 |
| 6 | Pesticide (not counting services embodied) | | | | |
| | Fungicide, 4% Cu(OH) ₂ | 0.77 kg | -- | 1 E7 SE kcal/g | 0.77 |
| | Insecticide, 1.5% BHC | 0.45 kg | 4.05 E3 | 1 E5 | 0.04 |
| 7 | Goods and Services including materials | | | | |
| | Estimated from costs plus tax | | | 1.65 E9 SE kcal/1980 \$ | 542 |
| | Subsidies of interest at 70% of inflation | | | " | 300 |
| | Machinery | 150 g | | 1.48 E6 SE kcal/g | 0.02 |
| 8 | Seedlings planted | 30 | -- | 1.65 E9 SE kcal/1980 \$ | 51 |
| 9 | Capital costs - driers | 1861 Cr 1980 | | " | 307 |
| | Total excluding double counters | | | | |
| 10 | Yield | 690 k4 | 4.14 E6 | 3.2 E6 | 1327.83 |

* Not included to avoid double counting.

Footnotes for Table 1 on Cacao

1. Solar insolation from unpublished data of climatology division of Cepec Divisão de Ciências Sociais Estatística, Mean, 3447 kcal/m²/d.
(mean of 1980, 3474; 1981, 3551; 1982 3501)
 $(3.447 \text{ E3 kcal/m}^2/\text{d})(365 \text{ d})(1 \text{ E4 m}^2/\text{ha}) = 1.258 \text{ E10}$
2. Transpiration of cacao plantations with overstory trees; estimate supplied by P. Alvim, CEPEC, 3.7 mm/day
 $(3.7 \text{ mm/d})(365 \text{ d})(1 \text{ E3 g H}_2\text{O/m}^2/\text{mm})(1 \text{ E4 m}^2/\text{ha}) = 1.35 \text{ E10 g water/ha/g}$
 $\frac{(1.35 \text{ E10 g H}_2\text{O/ha/y})(5 \text{ J/g water})}{4186 \text{ J/kcal}} = 1.61 \text{ E7 kcal/ha/y}$
3. Fertilizer
 - $(296 \text{ kg Adubo/ha/g})(130 \text{ g N/kg}) = 3.85 \text{ E4 g N}$
 $(80 \text{ kg urea})(14/60 \text{ g N/g urea}) = 1.87 \text{ E4}$
Total N = 5.72 E4 g N/ha/y
 - $(296 \text{ kg Adubo/ha})(350 \text{ g P/kg}) = 1.03 \text{ E5 g P}$
 $(296 \text{ kg Adubo/ha})(100 \text{ g K/kg}) = 2.96 \text{ E4 g K}$
 - 450 l lime (Ca, Mg, CO₃) @ density assumed 1.5 g/cm³
 $(450 \text{ E3 cm}^3)(1.5 \text{ g cm}^3) = 6.75 \text{ E5 g/ha}$
 - Energy transformation ratio of calcium carbonate (provisional pending better geologic data):
Rate of uplift and limestone rock circulating in continents,
7.7 E15 g/y; global energy responsible, 1.91 E21 SE Cal/y
(Odum and Odum, 1983)
Energy transformation ratio on weight basis:
 $\frac{1.91 \text{ E21 SE Cal}}{7.7 \text{ E15 g/y}} = 2.5 \text{ E5 SE Cal/g}$

4. Soil

Soil formation rate

$$\frac{(0.5 \text{ m})(1.4 \text{ E6 g/m}^3)}{500 \text{ y}} = 1400 \text{ g/m}^2/\text{y}$$

$$\text{Soil runoff } (1400/\text{m}^2/\text{y})(1 \text{ E4 m}^2/\text{ha}) = 1.4 \text{ E7 g/ha/y}$$

kg/ha/y:Ca, 2.16; mg 1.32; k 4.85; N 5.86; P 0.35

Runoff, 293 - 692 m³/ha/y

$$\text{Earth uplift generates clay: } (31.2 \text{ g/m}^2/\text{y})(1 \text{ E4 m}^2/\text{ha}) = 3.12 \text{ E5 g/ha/y}$$

If nitrogen runoff is 5.86 kg/ha/y and topsoil is 0.10% N

$$\frac{5.86 \text{ E3 g N/ha/y lost}}{0.0010 \text{ g N/g topsoil}} = 5.86 \text{ E6 g soil/ha/y or}$$

$$\frac{(5.86 \text{ E6 g soil/ha/y})}{(2 \text{ g cm}^3 \text{ density})(1 \text{ E8 cm}^2/\text{ha})} = 0.029 \text{ cm/y soil lost}$$

5. Fuels used per hectare (Cepec, 1984) for weeding, 2 l; for spraying, 45 l;

oil, 2.78 l; estimate fuel energy as octane:

$$(49.8 \text{ l/ha/y})(0.7 \text{ g ml})(13.0 \text{ kcal/g})(1 \text{ E3 ml/l}) = 4.54 \text{ E5 kcal/ha/y}$$

- 1.6 kg wood used/kg cacao (Brandão, 1977)

$$(640 \text{ kg cacao})(1.6 \text{ kg wood/kg cacao}) = 1024 \text{ kg wood}$$

$$(1.024 \text{ E6 g wood})(4 \text{ kcal/g}) = 4.1 \text{ E6 kcal wood used}$$

- Transport mean distance 500 m with mules eating hay:

3 boxes @ 21 kg/box/animal trip; 441 kg/trip

$$\frac{\text{yield } 690 \text{ kg/ha/yr}}{441 \text{ kg/trip}} = 1.56 \text{ trip/ha}$$

$$\frac{2400 \text{ trips/animal/yr}}{1.56 \text{ trips/ha}} = 1538 \text{ ha/animal}$$

2.4 mules/ha required for transport

(Brandão and Tafani, 1976)

$$(40 \text{ kg/mule/d})(365 \text{ d})(2.4 \text{ mules})(0.10 \text{ dry})(3.5 \text{ kcal/g}) = 12264 \text{ kcal/ha/d}$$

$$(1.23 \text{ E4 kcal/ha/d})(365 \text{ d}) = 4.49 \text{ E6 kcal hay/ha/y}$$

6. Pesticide used, Cepec 1984; ETR assumed from Austria study pending better data
 Fungicide (19.2 kg/ha)(0.04) = 0.77 kg Cu (OH)₂; ETR assumed higher than P
 Insecticide (30 kg/ha)(0.015) = 0.45 kg
 Organic pesticide (0.45 kg/ha)(9 kcal/g)(1 E3 g/kg) = 4050 kcal

7. Services including social costs (not including discount)
 531, 648. Cr (1984) from Cepec (1984)

1980 energy/dollar for Brazil 6.9 E 12 SEJ/\$

$$\frac{6.9 \text{ E12 SEJ}/\$}{4186 \text{ J/kcal}} = 1.65 \text{ E9 SE kcal}/\$ \text{ in 1980}$$

From inflation table, ratio of March 1980/1984 is $\frac{3339}{9777} = 0.34$

$$[5.317 \text{ E5 Cr (1984)}][0.34 \text{ 1980/1984}] = 180,773 \text{ Cr (1980)}$$

$$\frac{(1.808 \text{ E5 1980 Cr})}{(55 \text{ 1980 cr}/\$)} = (1.65 \text{ E9 SE kcal}/\$) = 5.42 \text{ E12 SE kcal embodied in Services}$$

Subsidies in loans at less interest than inflation

231% inflation; interest 70% of inflation = 161%:

$$(231 - 161\%)(430,684) = 3.0 \text{ E7 Cr (1984)}$$

$$(3.0 \text{ E7 Cr 1984})(0.34 \text{ Cr 1980/1984}) = 1.02 \text{ E7 Cr 1980}$$

$$\frac{1.02 \text{ E7 Cr (1980)}}{55 \text{ Cr 1980}/\$} = 1.86 \text{ E5\$}$$

$$(1.86 \text{ E5})(1.65 \text{ E9 SE kcal}/\$) = 3.0 \text{ E14}$$

Machinery

ETR includes goods and services and embodied fuels and earth work to concentrate iron ore. See G. Bosch, Appendix 13 (Odum and Odum, 1983)

6.94 E7 SEJ/1

$$\frac{(23.6 \text{ E22 SEJ})}{(4186 \text{ J/kcal})(38 \text{ E12 g end products})} = 1.48 \text{ E6 SE kcal/g}$$

Machinery used in drying sheds, spraying equipment, etc.

Steel in heating furnace

$$6 \text{ m} \times (2.7)(3.14)(0.3)(0.005 \text{ m})(5 \text{ g/cm}^3)(1 \text{ E6 cm}^3/\text{m}^3) = 2.82 \text{ E5 g steel}$$

$$(6 \times 6 \text{ m}^2)(0.002 \text{ m})(0.2 \text{ steel})(5 \text{ g/cm}^3)(1 \text{ E6 cm}^3/\text{m}^3) = 72000 \text{ g steel} = 0.72 \text{ E5}$$

$$(2.82 + 0.72) \text{ E5} = 4.54 \text{ E5 g steel}$$

$$\frac{4.5 \text{ E5 g}}{30 \text{ yrs}} = 15000 \text{ g/shed./yr}$$

$$\text{needed per ha } \left(\frac{0.37}{36}\right)(15000 \text{ g/shed./yr}) = 150 \text{ g steel end products/ha/y}$$

8. Seedlings

$$\frac{750 \text{ seedlings/ha}}{25 \text{ years}} = 30 \text{ seedlings/ha/yr}$$

Assume nursery prices for hybrid trees 10 US\$/seedling

$$(30)(\$10)(1.7 \text{ E9 SE kcal/1980\$}) = 51 \text{ E10}$$

9. Capital cost; wood-fired drier, 30 yr life

1728 kg yield/m² of drier; 640 kg/ha of trees

$$\frac{640 \text{ kg/ha trees}}{1728 \text{ kg/m}^2 \text{ drier/yr}} = 0.37 \text{ m}^2 \text{ drier/ha}$$

Drier 6 m x 6 m cost 16 E6 Cr (1984)

$$\frac{16 \text{ E6 (1984 Cr)}}{36 \text{ m}^2} = 4.44 \text{ E5 Cr 1984/m}^2$$

$$(4.44 \text{ E5 Cr 1984/m}^2)(0.37 \text{ m}^2 \text{ drier/ha}) = 1.64 \text{ E5 Cr 1984/ha}$$

$$\frac{1.64 \text{ E5 Cr 1984}}{30 \text{ yrs}} = 5476 \text{ Cr/1984/ha/y}$$

$$(5476 \text{ 1984 Cr/ha/y})\left(0.34 \frac{1980}{1984}\right) = 1861 \text{ Cr 1980/ha/y}$$

$$\frac{(1861 \text{ 1980 Cr/ha/y})(1.65 \text{ E9 SE kcal 1980 \$})}{(55 \text{ Cr/\$})} =$$

10. Yield (Cepec, 1984)

46 arrobas = 690 kg dried beans

$$(690 \text{ kg})(6 \text{ kcal/kg}) = 4140 \text{ kcal dried beans}$$

Seed content, 54% fat;

assumed 6 kcal/g dry seed

Table 2. Indices for perspectives.

| Index | Footnote | Value |
|--|----------|-------|
| Net energy yield ratio | 1 | 1.4 |
| Investment ratio | 2 | 17.5 |
| Energy balance ratio in U.S. sale out/in | 3 | 1.2 |
| Energy balance if fuel bought | 4 | 1.8 |
| Energy balance if cacao sold for fuel | 5 | 1.1 |

$$1. \quad (1328 \text{ SE kcal/ha/y}) / (309 + 542 + 72 + 3 + 0.8) \text{ SE kcal/ha/y}$$

$$2. \quad (309 + 542 + 72 + 3 + 0.8) / (25 + 14 + 14)$$

$$3. \quad \text{Embodied energy in cacao sold } 13.2 \text{ E12 SE kcal/ha/y}$$

$$\text{Sale price is } \frac{(1.43 \text{ E6 Cr})(0.34)(1980/1984)}{55 \text{ Cr/\$}} = \$7800 \text{ (1980\$)}$$

$$1980 \text{ U.S. energy/dollar ratio} = 1.65 \text{ E9 SE kcal/\$}$$

$$\text{Embodied energy received } (\$7800)(1.69 \text{ E9 SE kcal/\$}) = 12.9 \text{ E12 SE kcal/ha/y}$$

$$\text{out/in} = \frac{13.2 \text{ E12 SE kcal/ha/y}}{12 \text{ E12 SE kcal/ha/y}} = 1.2$$

$$4. \quad \frac{\text{Import of oil}}{\text{Export of \$}} = \frac{(1.6 \text{ E6 kcal/barrel})(5.3 \text{ E4 SE kcal/oil kcal})}{(\text{U.S. } \$29/\text{barrel})(1.6 \text{ E9 SE kcal/\$})} = 1.8$$

$$5. \quad \text{Motor fuel received: } (\$7800/\text{ha/yr})(3 \text{ liters/\$})(6.0 \text{ E8 SE kcal/l})$$

$$= 1.4 \text{ E13 SE kcal/ha/y}$$

$$\frac{\text{in}}{\text{out}} = \frac{1.4 \text{ E13 SE kcal/ha/y in fuel bought}}{1.32 \text{ E13 SE kcal/ha/y exported}}$$

$$= 1.06$$

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QUADRO 1. Orçamento de custos para exploração de 01 ha de cacaueiros comuns (densidade 800 plantas/ha) usando o Pacote Tecnológico. Atual e uma produtividade suposta de 690 kg vendidas ao preço médio de Cr\$ 31.200,00 (preço março/84). CEPEC (1984).

| Especificação | Valor | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | Parcial | Subtotal | Total | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. CUSTOS VARIÁVEIS TOTAIS (CVT) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1. Mão de obra | | 185.794,86 | 695.108,42 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Colheita e beneficiamento ^{1/} | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Desbrota | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reçagem (2 vezes) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calagem | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adubação básica | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Combate às pragas | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Controle de doenças (4 vezes) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Harvest and Processing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pruning | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pesticiding | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fertilizing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fungicide | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pesticide | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pesticide | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fuels | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fuels | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fertilizer (N, 130 g/kg; P, 350 g/kg; K, 100 g/kg) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Urea fertilizer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Juros s/Custeio + Proagro (31% das despesas acima) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Funrural (2,5% da Receita Bruta) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Encargos Sociais | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Férias (1/12 de 1.1.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13º mês (1/12 de 1.1.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Repouso remunerado (1/6 de 1.1.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Outras despesas (5% das despesas acima) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. RECEITA BRUTA (RB) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. MARGEM BRUTA DE LUCRO (MB) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. CUSTO VARIÁVEL UNITÁRIO (Cr\$/ (a)) (CVU) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. RELAÇÃO BENEFÍCIO/CUSTO VARIÁVEL (B/C) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Jornadas</td> <td style="width: 10%;">Salário/dia</td> <td style="width: 10%;">Quant.</td> <td style="width: 10%;">Preços</td> <td style="width: 10%;">Parcial</td> <td style="width: 10%;">Subtotal</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>-</td> <td>858,85</td> <td>30,00</td> <td>255,20</td> <td>39.507,10</td> <td>185.794,86</td> <td>695.108,42</td> </tr> <tr> <td>17,00</td> <td>2.527,78</td> <td>19,20</td> <td>2.752,00</td> <td>42.972,26</td> <td></td> <td></td> </tr> <tr> <td>3,19</td> <td>1.839,62</td> <td>450,00</td> <td>17,70</td> <td>5.868,39</td> <td></td> <td></td> </tr> <tr> <td>20,00</td> <td>1.835,74</td> <td>0,80</td> <td>1.400,00</td> <td>36.714,80</td> <td></td> <td></td> </tr> <tr> <td>2,00</td> <td>1.812,22</td> <td>2,00</td> <td>564,00</td> <td>3.624,44</td> <td></td> <td></td> </tr> <tr> <td>11,00</td> <td>1.788,15</td> <td>45,00</td> <td>564,00</td> <td>19.669,65</td> <td></td> <td></td> </tr> <tr> <td>3,00</td> <td>1.788,15</td> <td>2,78</td> <td>1.495,40</td> <td>5.364,45</td> <td></td> <td></td> </tr> <tr> <td>0,50</td> <td>2.611,54</td> <td>296,00</td> <td>424,80</td> <td>1.305,77</td> <td></td> <td></td> </tr> <tr> <td>12,00</td> <td>2.564,00</td> <td>80,00</td> <td>236,30</td> <td>30.768,00</td> <td></td> <td></td> </tr> <tr> <td colspan="4"> <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Insumos</td> <td style="width: 10%;">Quant.</td> <td style="width: 10%;">Preços</td> <td style="width: 10%;">Parcial</td> <td style="width: 10%;">Subtotal</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>BHC 1,5% (kg)</td> <td>30,00</td> <td>255,20</td> <td>7.656,00</td> <td>244.889,41</td> <td></td> </tr> <tr> <td>Cobre Sandoz (kg)</td> <td>19,20</td> <td>2.752,00</td> <td>52.838,40</td> <td></td> <td></td> </tr> <tr> <td>Calcário (litro)</td> <td>450,00</td> <td>17,70</td> <td>7.965,00</td> <td></td> <td></td> </tr> <tr> <td>Ag-bem (litro)</td> <td>0,80</td> <td>1.400,00</td> <td>1.120,00</td> <td></td> <td></td> </tr> <tr> <td>Combustível (BHC) (litro)</td> <td>2,00</td> <td>564,00</td> <td>1.128,00</td> <td></td> <td></td> </tr> <tr> <td>Combustível (Cobre) (litro)</td> <td>45,00</td> <td>564,00</td> <td>25.380,00</td> <td></td> <td></td> </tr> <tr> <td>Óleo 2T (litro)</td> <td>2,78</td> <td>1.495,40</td> <td>4.157,21</td> <td></td> <td></td> </tr> <tr> <td>Adubo B (kg)</td> <td>296,00</td> <td>424,80</td> <td>125.740,80</td> <td></td> <td></td> </tr> <tr> <td>Ureia (kg)</td> <td>80,00</td> <td>236,30</td> <td>18.904,00</td> <td></td> <td></td> </tr> </table> </td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="4"> <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Juros s/Custeio + Proagro (31% das despesas acima)</td> <td style="width: 10%;">Quant.</td> <td style="width: 10%;">Preços</td> <td style="width: 10%;">Parcial</td> <td style="width: 10%;">Subtotal</td> <td style="width: 10%;">Total</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>133.512,12</td> <td>Omit</td> </tr> <tr> <td>Funrural (2,5% da Receita Bruta)</td> <td></td> <td></td> <td></td> <td>35.880,00</td> <td></td> </tr> <tr> <td>Encargos Sociais</td> <td></td> <td></td> <td></td> <td>61.931,63</td> <td>1.01 E5</td> </tr> <tr> <td>Férias (1/12 de 1.1.)</td> <td></td> <td></td> <td></td> <td>15.482,91</td> <td></td> </tr> <tr> <td>13º mês (1/12 de 1.1.)</td> <td></td> <td></td> <td></td> <td>15.482,91</td> <td></td> </tr> <tr> <td>Repouso remunerado (1/6 de 1.1.)</td> <td></td> <td></td> <td></td> <td>30.965,81</td> <td></td> </tr> <tr> <td>Outras despesas (5% das despesas acima)</td> <td></td> <td></td> <td></td> <td>33.100,40</td> <td></td> </tr> <tr> <td>RECEITA BRUTA (RB)</td> <td></td> <td></td> <td></td> <td>1.435.200,00</td> <td></td> </tr> <tr> <td>MARGEM BRUTA DE LUCRO (MB)</td> <td></td> <td></td> <td></td> <td>740.091,58</td> <td></td> </tr> <tr> <td>CUSTO VARIÁVEL UNITÁRIO (Cr\$/ (a)) (CVU)</td> <td></td> <td></td> <td></td> <td>15.111,05</td> <td></td> </tr> <tr> <td>RELAÇÃO BENEFÍCIO/CUSTO VARIÁVEL (B/C)</td> <td></td> <td></td> <td></td> <td>2,06</td> <td></td> </tr> </table> </td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> | | | | Jornadas | Salário/dia | Quant. | Preços | Parcial | Subtotal | Total | - | 858,85 | 30,00 | 255,20 | 39.507,10 | 185.794,86 | 695.108,42 | 17,00 | 2.527,78 | 19,20 | 2.752,00 | 42.972,26 | | | 3,19 | 1.839,62 | 450,00 | 17,70 | 5.868,39 | | | 20,00 | 1.835,74 | 0,80 | 1.400,00 | 36.714,80 | | | 2,00 | 1.812,22 | 2,00 | 564,00 | 3.624,44 | | | 11,00 | 1.788,15 | 45,00 | 564,00 | 19.669,65 | | | 3,00 | 1.788,15 | 2,78 | 1.495,40 | 5.364,45 | | | 0,50 | 2.611,54 | 296,00 | 424,80 | 1.305,77 | | | 12,00 | 2.564,00 | 80,00 | 236,30 | 30.768,00 | | | <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Insumos</td> <td style="width: 10%;">Quant.</td> <td style="width: 10%;">Preços</td> <td style="width: 10%;">Parcial</td> <td style="width: 10%;">Subtotal</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>BHC 1,5% (kg)</td> <td>30,00</td> <td>255,20</td> <td>7.656,00</td> <td>244.889,41</td> <td></td> </tr> <tr> <td>Cobre Sandoz (kg)</td> <td>19,20</td> <td>2.752,00</td> <td>52.838,40</td> <td></td> <td></td> </tr> <tr> <td>Calcário (litro)</td> <td>450,00</td> <td>17,70</td> <td>7.965,00</td> <td></td> <td></td> </tr> <tr> <td>Ag-bem (litro)</td> <td>0,80</td> <td>1.400,00</td> <td>1.120,00</td> <td></td> <td></td> </tr> <tr> <td>Combustível (BHC) (litro)</td> <td>2,00</td> <td>564,00</td> <td>1.128,00</td> <td></td> <td></td> </tr> <tr> <td>Combustível (Cobre) (litro)</td> <td>45,00</td> <td>564,00</td> <td>25.380,00</td> <td></td> <td></td> </tr> <tr> <td>Óleo 2T (litro)</td> <td>2,78</td> <td>1.495,40</td> <td>4.157,21</td> <td></td> <td></td> </tr> <tr> <td>Adubo B (kg)</td> <td>296,00</td> <td>424,80</td> <td>125.740,80</td> <td></td> <td></td> </tr> <tr> <td>Ureia (kg)</td> <td>80,00</td> <td>236,30</td> <td>18.904,00</td> <td></td> <td></td> </tr> </table> | | | | Insumos | Quant. | Preços | Parcial | Subtotal | Total | BHC 1,5% (kg) | 30,00 | 255,20 | 7.656,00 | 244.889,41 | | Cobre Sandoz (kg) | 19,20 | 2.752,00 | 52.838,40 | | | Calcário (litro) | 450,00 | 17,70 | 7.965,00 | | | Ag-bem (litro) | 0,80 | 1.400,00 | 1.120,00 | | | Combustível (BHC) (litro) | 2,00 | 564,00 | 1.128,00 | | | Combustível (Cobre) (litro) | 45,00 | 564,00 | 25.380,00 | | | Óleo 2T (litro) | 2,78 | 1.495,40 | 4.157,21 | | | Adubo B (kg) | 296,00 | 424,80 | 125.740,80 | | | Ureia (kg) | 80,00 | 236,30 | 18.904,00 | | | | | | | | <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Juros s/Custeio + Proagro (31% das despesas acima)</td> <td style="width: 10%;">Quant.</td> <td style="width: 10%;">Preços</td> <td style="width: 10%;">Parcial</td> <td style="width: 10%;">Subtotal</td> <td style="width: 10%;">Total</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>133.512,12</td> <td>Omit</td> </tr> <tr> <td>Funrural (2,5% da Receita Bruta)</td> <td></td> <td></td> <td></td> <td>35.880,00</td> <td></td> </tr> <tr> <td>Encargos Sociais</td> <td></td> <td></td> <td></td> <td>61.931,63</td> <td>1.01 E5</td> </tr> <tr> <td>Férias (1/12 de 1.1.)</td> <td></td> <td></td> <td></td> <td>15.482,91</td> <td></td> </tr> <tr> <td>13º mês (1/12 de 1.1.)</td> <td></td> <td></td> <td></td> <td>15.482,91</td> <td></td> </tr> <tr> <td>Repouso remunerado (1/6 de 1.1.)</td> <td></td> <td></td> <td></td> <td>30.965,81</td> <td></td> </tr> <tr> <td>Outras despesas (5% das despesas acima)</td> <td></td> <td></td> <td></td> <td>33.100,40</td> <td></td> </tr> <tr> <td>RECEITA BRUTA (RB)</td> <td></td> <td></td> <td></td> <td>1.435.200,00</td> <td></td> </tr> <tr> <td>MARGEM BRUTA DE LUCRO (MB)</td> <td></td> <td></td> <td></td> <td>740.091,58</td> <td></td> </tr> <tr> <td>CUSTO VARIÁVEL UNITÁRIO (Cr\$/ (a)) (CVU)</td> <td></td> <td></td> <td></td> <td>15.111,05</td> <td></td> </tr> <tr> <td>RELAÇÃO BENEFÍCIO/CUSTO VARIÁVEL (B/C)</td> <td></td> <td></td> <td></td> <td>2,06</td> <td></td> </tr> </table> | | | | Juros s/Custeio + Proagro (31% das despesas acima) | Quant. | Preços | Parcial | Subtotal | Total | | | | | 133.512,12 | Omit | Funrural (2,5% da Receita Bruta) | | | | 35.880,00 | | Encargos Sociais | | | | 61.931,63 | 1.01 E5 | Férias (1/12 de 1.1.) | | | | 15.482,91 | | 13º mês (1/12 de 1.1.) | | | | 15.482,91 | | Repouso remunerado (1/6 de 1.1.) | | | | 30.965,81 | | Outras despesas (5% das despesas acima) | | | | 33.100,40 | | RECEITA BRUTA (RB) | | | | 1.435.200,00 | | MARGEM BRUTA DE LUCRO (MB) | | | | 740.091,58 | | CUSTO VARIÁVEL UNITÁRIO (Cr\$/ (a)) (CVU) | | | | 15.111,05 | | RELAÇÃO BENEFÍCIO/CUSTO VARIÁVEL (B/C) | | | | 2,06 | | | | | | |
| Jornadas | Salário/dia | Quant. | Preços | Parcial | Subtotal | Total | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - | 858,85 | 30,00 | 255,20 | 39.507,10 | 185.794,86 | 695.108,42 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17,00 | 2.527,78 | 19,20 | 2.752,00 | 42.972,26 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3,19 | 1.839,62 | 450,00 | 17,70 | 5.868,39 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20,00 | 1.835,74 | 0,80 | 1.400,00 | 36.714,80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2,00 | 1.812,22 | 2,00 | 564,00 | 3.624,44 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11,00 | 1.788,15 | 45,00 | 564,00 | 19.669,65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3,00 | 1.788,15 | 2,78 | 1.495,40 | 5.364,45 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0,50 | 2.611,54 | 296,00 | 424,80 | 1.305,77 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12,00 | 2.564,00 | 80,00 | 236,30 | 30.768,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Insumos</td> <td style="width: 10%;">Quant.</td> <td style="width: 10%;">Preços</td> <td style="width: 10%;">Parcial</td> <td style="width: 10%;">Subtotal</td> <td style="width: 10%;">Total</td> </tr> <tr> <td>BHC 1,5% (kg)</td> <td>30,00</td> <td>255,20</td> <td>7.656,00</td> <td>244.889,41</td> <td></td> </tr> <tr> <td>Cobre Sandoz (kg)</td> <td>19,20</td> <td>2.752,00</td> <td>52.838,40</td> <td></td> <td></td> </tr> <tr> <td>Calcário (litro)</td> <td>450,00</td> <td>17,70</td> <td>7.965,00</td> <td></td> <td></td> </tr> <tr> <td>Ag-bem (litro)</td> <td>0,80</td> <td>1.400,00</td> <td>1.120,00</td> <td></td> <td></td> </tr> <tr> <td>Combustível (BHC) (litro)</td> <td>2,00</td> <td>564,00</td> <td>1.128,00</td> <td></td> <td></td> </tr> <tr> <td>Combustível (Cobre) (litro)</td> <td>45,00</td> <td>564,00</td> <td>25.380,00</td> <td></td> <td></td> </tr> <tr> <td>Óleo 2T (litro)</td> <td>2,78</td> <td>1.495,40</td> <td>4.157,21</td> <td></td> <td></td> </tr> <tr> <td>Adubo B (kg)</td> <td>296,00</td> <td>424,80</td> <td>125.740,80</td> <td></td> <td></td> </tr> <tr> <td>Ureia (kg)</td> <td>80,00</td> <td>236,30</td> <td>18.904,00</td> <td></td> <td></td> </tr> </table> | | | | Insumos | Quant. | Preços | Parcial | Subtotal | Total | BHC 1,5% (kg) | 30,00 | 255,20 | 7.656,00 | 244.889,41 | | Cobre Sandoz (kg) | 19,20 | 2.752,00 | 52.838,40 | | | Calcário (litro) | 450,00 | 17,70 | 7.965,00 | | | Ag-bem (litro) | 0,80 | 1.400,00 | 1.120,00 | | | Combustível (BHC) (litro) | 2,00 | 564,00 | 1.128,00 | | | Combustível (Cobre) (litro) | 45,00 | 564,00 | 25.380,00 | | | Óleo 2T (litro) | 2,78 | 1.495,40 | 4.157,21 | | | Adubo B (kg) | 296,00 | 424,80 | 125.740,80 | | | Ureia (kg) | 80,00 | 236,30 | 18.904,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Insumos | Quant. | Preços | Parcial | Subtotal | Total | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BHC 1,5% (kg) | 30,00 | 255,20 | 7.656,00 | 244.889,41 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cobre Sandoz (kg) | 19,20 | 2.752,00 | 52.838,40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calcário (litro) | 450,00 | 17,70 | 7.965,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ag-bem (litro) | 0,80 | 1.400,00 | 1.120,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Combustível (BHC) (litro) | 2,00 | 564,00 | 1.128,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Combustível (Cobre) (litro) | 45,00 | 564,00 | 25.380,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Óleo 2T (litro) | 2,78 | 1.495,40 | 4.157,21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adubo B (kg) | 296,00 | 424,80 | 125.740,80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ureia (kg) | 80,00 | 236,30 | 18.904,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Juros s/Custeio + Proagro (31% das despesas acima)</td> <td style="width: 10%;">Quant.</td> <td style="width: 10%;">Preços</td> <td style="width: 10%;">Parcial</td> <td style="width: 10%;">Subtotal</td> <td style="width: 10%;">Total</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>133.512,12</td> <td>Omit</td> </tr> <tr> <td>Funrural (2,5% da Receita Bruta)</td> <td></td> <td></td> <td></td> <td>35.880,00</td> <td></td> </tr> <tr> <td>Encargos Sociais</td> <td></td> <td></td> <td></td> <td>61.931,63</td> <td>1.01 E5</td> </tr> <tr> <td>Férias (1/12 de 1.1.)</td> <td></td> <td></td> <td></td> <td>15.482,91</td> <td></td> </tr> <tr> <td>13º mês (1/12 de 1.1.)</td> <td></td> <td></td> <td></td> <td>15.482,91</td> <td></td> </tr> <tr> <td>Repouso remunerado (1/6 de 1.1.)</td> <td></td> <td></td> <td></td> <td>30.965,81</td> <td></td> </tr> <tr> <td>Outras despesas (5% das despesas acima)</td> <td></td> <td></td> <td></td> <td>33.100,40</td> <td></td> </tr> <tr> <td>RECEITA BRUTA (RB)</td> <td></td> <td></td> <td></td> <td>1.435.200,00</td> <td></td> </tr> <tr> <td>MARGEM BRUTA DE LUCRO (MB)</td> <td></td> <td></td> <td></td> <td>740.091,58</td> <td></td> </tr> <tr> <td>CUSTO VARIÁVEL UNITÁRIO (Cr\$/ (a)) (CVU)</td> <td></td> <td></td> <td></td> <td>15.111,05</td> <td></td> </tr> <tr> <td>RELAÇÃO BENEFÍCIO/CUSTO VARIÁVEL (B/C)</td> <td></td> <td></td> <td></td> <td>2,06</td> <td></td> </tr> </table> | | | | Juros s/Custeio + Proagro (31% das despesas acima) | Quant. | Preços | Parcial | Subtotal | Total | | | | | 133.512,12 | Omit | Funrural (2,5% da Receita Bruta) | | | | 35.880,00 | | Encargos Sociais | | | | 61.931,63 | 1.01 E5 | Férias (1/12 de 1.1.) | | | | 15.482,91 | | 13º mês (1/12 de 1.1.) | | | | 15.482,91 | | Repouso remunerado (1/6 de 1.1.) | | | | 30.965,81 | | Outras despesas (5% das despesas acima) | | | | 33.100,40 | | RECEITA BRUTA (RB) | | | | 1.435.200,00 | | MARGEM BRUTA DE LUCRO (MB) | | | | 740.091,58 | | CUSTO VARIÁVEL UNITÁRIO (Cr\$/ (a)) (CVU) | | | | 15.111,05 | | RELAÇÃO BENEFÍCIO/CUSTO VARIÁVEL (B/C) | | | | 2,06 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Juros s/Custeio + Proagro (31% das despesas acima) | Quant. | Preços | Parcial | Subtotal | Total | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | 133.512,12 | Omit | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Funrural (2,5% da Receita Bruta) | | | | 35.880,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Encargos Sociais | | | | 61.931,63 | 1.01 E5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Férias (1/12 de 1.1.) | | | | 15.482,91 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13º mês (1/12 de 1.1.) | | | | 15.482,91 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Repouso remunerado (1/6 de 1.1.) | | | | 30.965,81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Outras despesas (5% das despesas acima) | | | | 33.100,40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RECEITA BRUTA (RB) | | | | 1.435.200,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MARGEM BRUTA DE LUCRO (MB) | | | | 740.091,58 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CUSTO VARIÁVEL UNITÁRIO (Cr\$/ (a)) (CVU) | | | | 15.111,05 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RELAÇÃO BENEFÍCIO/CUSTO VARIÁVEL (B/C) | | | | 2,06 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

1/ Custo apropriado por arroba.

SIMULATION MODEL OF CACAO

H.T. Odum

In Figure 1 is a simulation model of cacao production, processing and sale. It has the form of the more detailed diagrams given with the energy analysis, but is simpler. This model is simulated on Apple 2C computer with graphs of Figure 2 resulting. The program is given in Table 1.

This model is probably too simple to represent the real system adequately, but it represents a beginning, showing the methods, including the way coefficients are calculated from the values of storages and flows in Figure 1.

Figure 2 has two simulations. In (a) prices are high as in 1984 and phosphate fertilizer reasonably low. In (b) prices are lower and phosphate fertilizer more costly. Nutrient levels are less, plantations grow more slowly, and income is less.

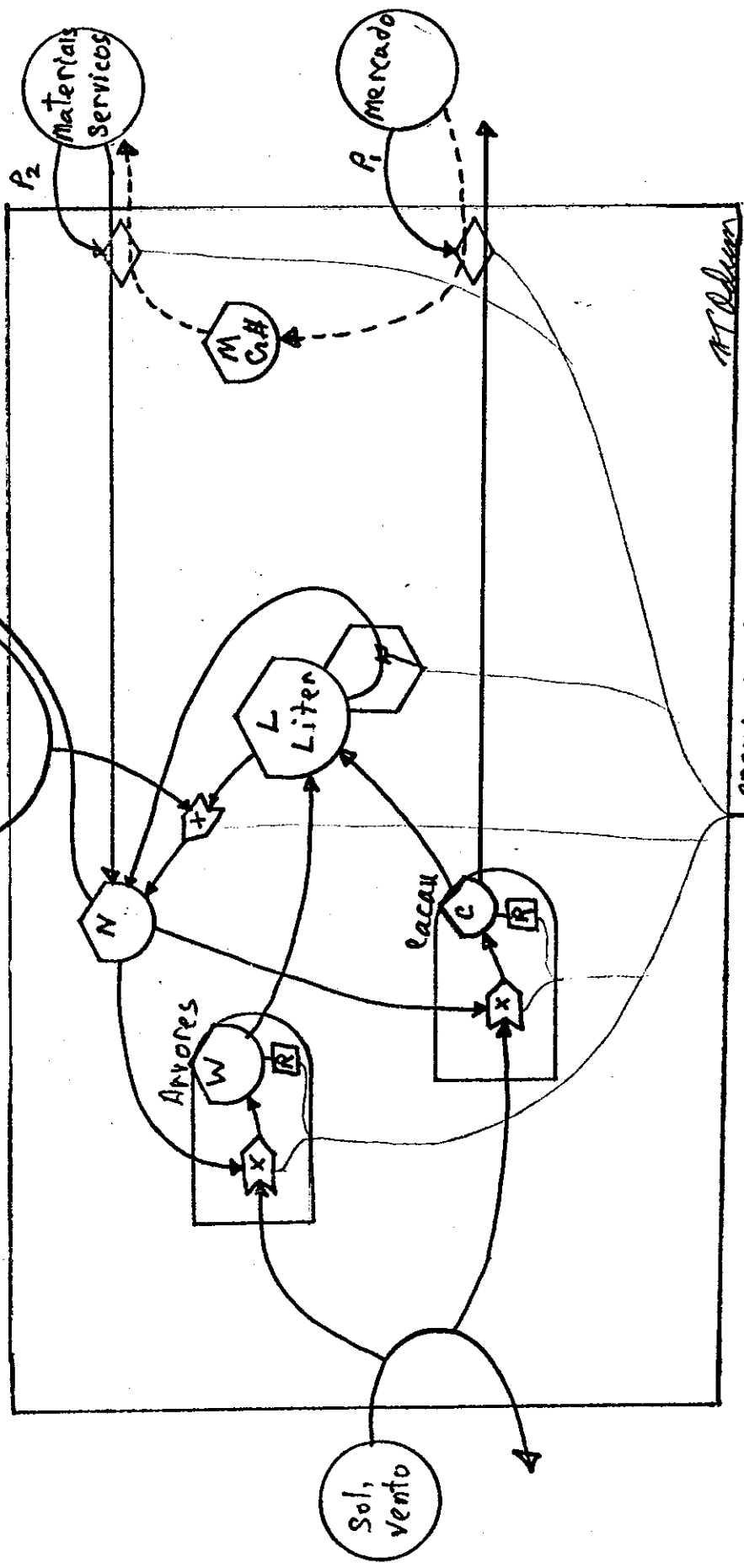
The next step may be to add disease, pesticide, another nutrient, etc. The thesis by Christianson (1983) has two models of wood and paper production at Jari that are more complex. However, if models are more complex than can be drawn on a page, they are probably too complex to visualize, to trust, to debug, calibrate, or use easily.

REFERENCES CITED

- Christianson, R.A. 1984. Energy perspectives on a tropical forest plantation system at Jari, Brazil. M.S. Thesis. Dept. of Environmental Engineering Sciences, University of Florida, Gainesville, Florida. 167 pp.
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Rochas em
decomposiçao

Escrapamento



$$R_1 = \frac{I_0}{(1+R_0N)}$$

$$R_2 = \frac{R_1}{(1+R_1N)}$$

$$M_1 = \frac{N_1}{(1+h_9L)}$$

$$\dot{W} = A_2 R_1 N - A_3 W - A_4 W$$

$$\dot{N} = A_5 N_1 L + A_6 L + \frac{A_7 M}{T_2} - A_8 N R_1 - L_7 N R_2$$

$$\dot{C} = L_4 R_2 N - L_5 C - L_6 C - L_2 C$$

$$\dot{M} = T_1 L_6 C - A_9 M$$

modelo por simulaçao

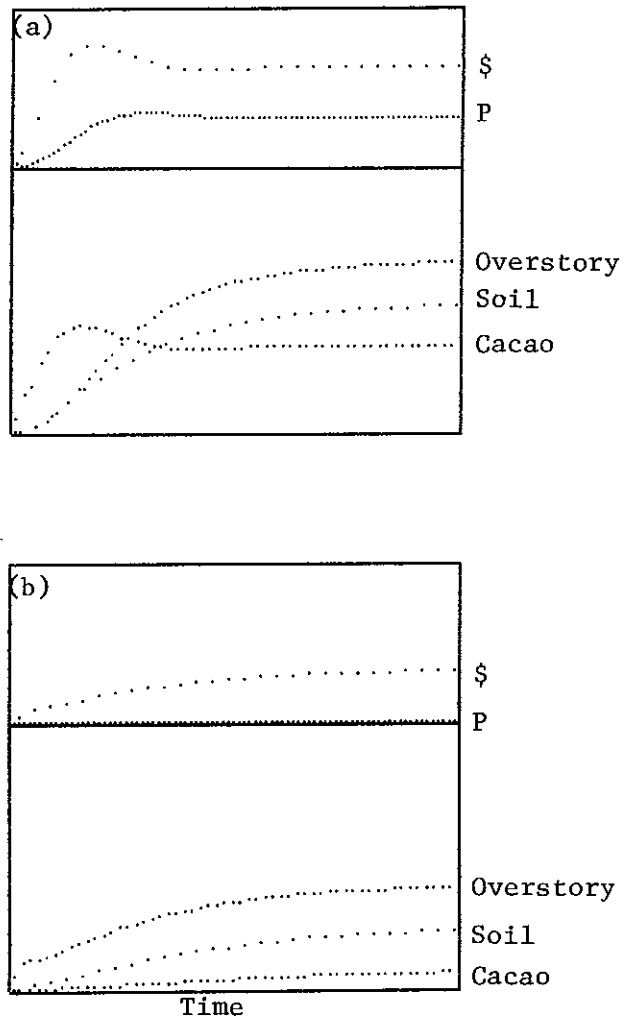


Figure 2. Simulation of cacao model in Figure 1. (a) With present availability of inputs and prices of cacao; (b) with higher cost of phosphate fertilizer and lower sale prices.

$$\dot{R}_1 = I_0 - k_0 R_1 N$$

$$\therefore R_1 = \frac{I_0}{(1+k_0 N)}$$

$$\dot{W} = k_2 R_1 N - k_3 W - k_4 W$$

$$\dot{N} = k_5 N_1 L + k_6 L + \frac{k_7 M}{P_2} - k_8 N R_1 = L_7 N R_2$$

$$\dot{L} = L_1 W + L_2 C - L_3 L$$

$$\dot{M} = P_1 L_6 C - k_9 M$$

$$R_2 = R_1 - k_1 R_2 N$$

$$\therefore R_2 = \frac{R_1}{(1+k_1 N)}$$

$$N_1 = N_0 - L_9 L N_1$$

$$\therefore N_1 = \frac{N_0}{(1+L_9 L)}$$

$$\dot{C} = L_4 R_2 N - L_5 C - L_6 C - L_2 C$$

$$k_0 R_1 N = 0.5$$

$$k_1 R_2 N = 0.45$$

$$k_2 R_1 N = 3000$$

$$k_3 W = 1000$$

$$k_4 W = 2000$$

$$k_5 L = 7$$

$$k_6 L = 6$$

$$k_7 M = 70$$

$$k_8 R_1 N = 54$$

$$k_9 M = 647$$

$$k_0 = \frac{0.5}{(0.5)(200)} = 0.005$$

$$k_1 = \frac{0.45}{(0.05)(200)} = 0.045$$

$$k_2 = \frac{3000}{(0.5)(300)} = 30$$

$$k_3 = \frac{1000}{50000} = 0.02$$

$$k_4 = \frac{2000}{50000} = 0.04$$

$$k_5 = \frac{7}{50000} = 0.00014$$

$$k_6 = \frac{6}{50000} = 0.00012$$

$$k_7 = \frac{70}{1000} = 0.07$$

$$k_8 = \frac{54}{(0.5)(200)} = 0.54$$

$$k_9 = \frac{647}{1000} = 0.65$$

$$L_1 W = 3000$$

$$L_1 = \frac{3000}{50000} = 0.06$$

$$L_2 C = 3000$$

$$L_2 = \frac{3000}{50000} = 0.06$$

$$L_3 L = 6000$$

$$L_3 = \frac{6000}{50000} = 0.12$$

$$L_4 R_2 N = 6000$$

$$L_4 = \frac{6000}{(0.05)(200)} = 600$$

$$L_5 C = 3000$$

$$L_5 = \frac{3000}{500,000} = 0.06$$

$$L_6 C = 640$$

$$L_6 = \frac{640}{50000} = 0.013$$

$$L_7 NR_2 = 53$$

$$L_7 = \frac{53}{(200)(0.05)} = 5.3$$

$$L_8 N = 7$$

$$L_8 = \frac{7}{200} = 0.035$$

$$L_9 N_1 L = 7$$

$$L_9 = \frac{7}{(0.5)(50000)} = 2.8 \text{ E-4}$$

Table 1. Apple BASIC program for simulating the model in Figure 1.

```
3 REM CACAO
4 HGR : HCOLOR= 3
5 HPLLOT 0,60 TO 278,60
6 HPLLOT 0,0 TO 0,159 TO 279,159 TO 279,0 TO 0,0
7 HCOLOR= 5
10 REM ARK: SCALING FACTORS
12 I = 1
14 TO = .5
15 TO = .3
16 W0 = 1000
18 M0 = 20
20 L0 = 1000
22 C0 = 1000
24 N0 = 20
30 IO = 1
35 T = 0
70 REM OUTSIDE SOURCES
75 IF X = 1 GOTO 105
80 F1 = 1.12
90 F2 = .7
105 NI = 7.5
110 I = 1
120 REM INITIAL QUANTITIES
125 C = 1000
130 M = 100
135 W = 1000
140 L = 1000
145 N = 20
147 K0 = .005
149 K1 = .045
150 REM COEFFICIENTS
151 K2 = 30
153 K3 = .02
155 K4 = .04
157 K5 = .00014
159 K6 = .00012
161 K7 = .07
163 K8 = .54
165 K9 = .65
167 L1 = .06
169 L2 = .06
171 L3 = .12
173 L4 = 600
175 L5 = .06
177 L6 = .013
179 L7 = 5.3
181 L8 = .035
183 L9 = 2.8E - 4
```

```

200 REM PLOTTING
220 HCOLOR= 1
230 HPLOT T / TO,160 - W / W0
240 HCOLOR= 2
250 HPLOT T / TO,160 - L / L0
260 HCOLOR= 3
270 HPLOT T / TO,60 - N / N0
280 HCOLOR= 5
285 HPLOT T / TO,160 - C / C0
290 HCOLOR= 6
295 HPLOT T / TO,60 - M / M0
300 REM ARK: EQUATIONS
305 R1 = IO / (1 + KO * N)
310 R2 = R1 / (1 + K1 * N)
312 N1 = NI / (1 + L9 * L)
315 REM CHANGE EQUATIONS:
320 DW = K2 * R1 * N - K3 * W - K4 * W
325 DN = K5 * N1 * L + K6 * L + K7 * M / P2 - K8 * N * R1 - LB * N
330 DL = L1 * W + L2 * C - L3 * L
335 DM = P1 * L6 * C - K9 * M
340 DC = L4 * R2 * N - L5 * C - L6 * C - L2 * C
350 REM ARK: NEW VALUES OF STORAGES
352 M = M + DM * I
355 L = L + DL * I
360 W = W + DW * I
365 N = N + DN * I
370 C = C + DC * I
390 T = T + I
395 REM GO BACK AND PLOT VALUES FOR THE NEXT INTERVAL OF TIME
400 IF T / TO < 279 GOTO 200
500 END
505 X = 1
510 P1 = .5
520 P2 = 10
530 GOTO 4

```