vestigados métodos que possibilitem uma imunodiagnose para este tipo de anisaquíase.

Embora no Brasil não tenha sido relatado nenhum caso, a anisaquíase oferece perigo potencial para as populações que têm o hábito de consumir peixe cru ou apenas temperado ("sashimi") como ocorre entre os imigrantes japoneses e coreanos. Como medida profilática recomenda-se evitar o consumo de pescados crus ou defumados; permitir-se esta forma de alimento apenas para o pescado que tenha sido congelado a -20°C por 24 horas, pois, com este procedimento, as larvas morrem. De preferência o pescado deve consumir-se frito, cozido ou ao forno, pois a temperatura de 60°C durante 10 minutos é suficiente para que morram todas as larvas (7).

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SYSTEM OF ETHANOL PRODUCTION FROM SUGARCANE IN BRAZIL

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RESUMO. *Sistema de produção de etanol a partir da cana-de-açúcar no Brasil.* O sistema de produção de cana-de-açúcar e de etanol na Empresa "Embaúba", situada em Barrolândia, Bahia, Brasil, foi avaliado em termos de "energia solar incorporada" (joules), levando-se em conta todos os insumos do governo e da economia, multiplicados por apropriados joules solares, requeridos por unidade de insumo.
O combustível líquido produzido foi 7,6 vezes maior do que o combustível líquido usado no processo. Entretanto, com todos os insumos incluídos, a taxa de produção de energia líquida foi ligeiramente superior à unidade (1,14), o que comprova que o álcool de cana-de-açúcar não estimula a economia.

A energia incorporada foi de 8,8 x 10^4 joules solares por joule de álcool. Em virtude de sua abundante energia incorporada, o álcool fornece três vezes mais estímulos econômicos aos países que o compraram do que o valor recebido pela economia brasileira, motivo por que não deve ser vendido para o exterior.
Pelo fato de a energia rural incorporada em moeda brasileira (6,9 x 10^{12} joules solares/US$ 1980) ser superior à contida em moeda americana (2,6 x 10^{12} joules solares US$ 1980), o Brasil não promove um estímulo econômico através da compra de combustível da OPEP comparável ao observado nos países desenvolvidos.

ABSTRACT. The system of sugarcane and ethanol production at the "Embaúba" Company, in Barrolândia, Bahia, Brazil was evaluated in embodied solar joules. This was done by evaluating all inputs from government and from the economy and multiplying by the appropriate solar joules required per unit of input.
The liquid fuel produced was 7.6 times that liquid fuel used in the process. However, with all inputs included, the net energy yield ratio was hardly more than one (1.14). Thus, alcohol from sugarcane does not stimulate the economy.
Embodied energy was 8.8 x 10^4 solar joules per joule of alcohol. Because of its high embodied energy, it supplies three times more economic stimulus to countries that buy it than is received for the Brazilian economy. Alcohol should not be sold abroad.
Beaceuse more rural embodied energy is represented in Brazilian currency (6.9 x 10^{12} solar joules/U.S. 1980 $) than in U.S. currency (2.6 x 10^{12} solar joules/1980 U.S. $), Brazil does not get the economic stimulus from buying OPEC oil that urban nations do.

INTRODUCTION

Energy analysis is a new way of determining the economic value of a system, like ethanol production from sugarcane. The flows and processes of the system are combined, using energy to evaluate the inputs and yields. Included are the embodied energy values of the rain, fertilizer elements, fuels, goods and services, and the produc yields.

METHODS

Energy of inflows and outputs are estimated with the help of a computer spread sheet (Acecalc). After actual energy flows are determined, embodied energy values are calculated. These values include both the energy used to produce the item and the fuel and human service necessary to make it available. For example, the embodied energy value of phosphate fertilizer is the energy required by the geological processes which produced it plus the industrial and human work to manufacture it into fertilizer.

To compare the embodied energy values of each item, its value in joules of sunlight was calculated by multiplying by an energy transformation ratio (ETR) to obtain its energy equivalent in solar energy units.

The various flows all expressed in solar equivalent joules can now be compared since they are expressed in the same units. Several ratios were calculated from these flows to gain perspective. More detail on methods is given in a previous paper (12).

Energy Analysis Table

The energy values are given in the Table I spread sheet, which has basis for the calculations in the footnotes. The columns include annual flows, using 1980 data, energy transformation ratios, and the solar equivalent values of the flows in joules and kilocalories.

For human services measured in cruzeiros, the Cr$/US$ ratio for 1980 was used to calculate the US exchange equivalent. Then the dollars were given an energy value from the Brazilian embodied energy/dollar ratio calculated in a previous study of Brazil (12).

RESULTS

Environmental inputs to this system of production of ethanol from sugarcane were the rain transpired by the plants; fertilizers (about 16% of the total inputs); and fuels, both direct (5%) and indirect used in pesticides, seeding, machinery, fertilizers, and goods and services. The paid-for inputs are the goods and services used for processing and delivery. Some bagasse, a residue from the sugarcane milling process, reduced the inputs by being used to make electricity for milling and heat for the ethanol distilling. In the calculation, the excess bagasse yield was used to reduce the total inputs (15%).

Energy Systems Diagram

An energy systems diagram is given in Fig. 1 using energy language symbols (10). The embodied energy values for the inputs and yields are given on the diagrams. The net energy is the ratio of the ethanol output to the sum of feedback inputs coming from the right. A measure of relative contribution of purchased and free environmental inputs was also calculated as a ratio (feedbacks per environmental input).

Energy Indices for Comparisons

In Table II are given some ratios calculated from data in Fig. 1 and Table I.

DISCUSSION

The net energy ratio of 1.1 to 1 indicates that the production of ethanol from sugarcane yielded only a little more energy than was used in the process. However, eight times more liquid fuel was produced than used (Table II). Although fuel was successfully generated from solar energy, it was not a stimulus to the economy. Countries that have oil or some that purchase it at current prices gain a positive net energy which stimulates other aspects of the economy. For Brazil the ratio of embodied energy in gasoline purchased abroad to that in services represented by dollars used to buy the fuel is 1.1 (footnote 37). Thus, little stimulus to the economy is obtained either by producing alcohol or buying gasoline. There is little advantage in costs to purchasing liquid fuel abroad or making it at home.

Ninety-eight percent of the ethanol produced in 1980 was exported (3). The ratio of goods and services imported from the United States for ethanol exported is 0.30 (3.3/1 the reciprocal) (footnote 32). This means that for every 3.3 units of embodied energy of alcohol exported, only 1 comes back from the USA as goods and services. In 1984 the ratio was even less, 0.23. The sale price for ethanol had decreased, and the energy/dollar ratio of the US had also decreased (footnote 33).

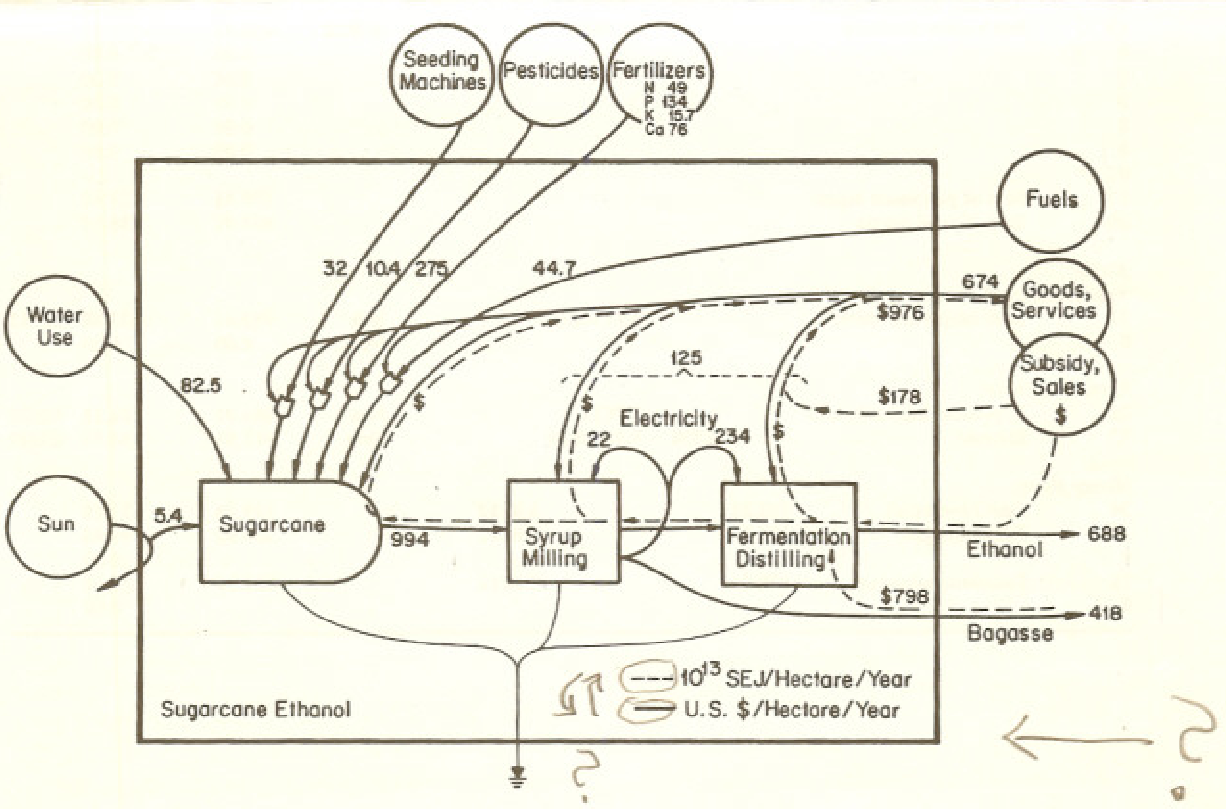

Figure 1

Table I – Energy analysis of sugarcane in Brazil (per hectare).

Footnote	*Item*	*Dollar flow (1980$)*	*Mass flow*	*Actual energy*	*Energy transformation ratios*			*Embodied solar energy*		*New ETRs*
		US$/y	g/y	J/y	SEJ/$	SEJ/g	SEJ/J	E13 SEJ/y	E10 SEKcal/y	SEJ/J
Inputs to agricultural phase:										
1	Direct solar energy			5.4E13			1	5.40	1.29	
2	Water transpired			5.5E10			15000	82.50	19.71	
3	Nitrogen fertilizer		118000			4.19E9		49.44	11.81	
4	Potassium fertilizer		165000			9.5E8		15.68	3.74	
5	Phosphorus fertilizer		66885			2E10		113.77	31.96	
6	Calcium (lime)		289000			2.63E9		76.01	18.16	
7	Fuel in pesticide			1.58E9			66000	10.43	2.49	
8	Direct fuel use			-6.77E9			66000	44.68	10.67	
9	Fuel: seed., machines, fert.			4.85E9			66000	32.01	7.65	
10	Goods-services, agr. prod.	795.85			6.9E12			549.14	131.18	
0										
0										
0										
0								—	—	
11	Sum of purchased inputs							911.15	217.67	
12	Sum of total ag. inputs							993.65	237.38	
Inputs to processing phase:										
13	Input from cane product.							993.65	237.38	
14	Bagasse generated electr.			1.41062E9			159000	22.43	5.36	
15	Bagasse as process fuel			4.0905E10			62522	255.75	61.10	
16	Goods-services, processing	180.68			6.9E12			124.67	29.78	
17	Subtract internal bagasse							-278.18	-66.45	
18	Net bagasse feedback			-7.3E10			62522	-456.41	-109.03	
0								0.00	0.00	
0								0.00	0.00	
0								0.00	0.00	
0								0.00	0.00	
0								0.00	0.00	
0								—	—	
19	Sum of purchased inputs							579.41	138.42	
20	Sum of total inputs							661.91	158.13	
Yields:										
Agricultura yields: (sugarcane)										
21	Main crop yield (cane)			3.1136E11			New	993.65	237.38	31913
0							New	0.00	0.00	
Processing yields:										
22	Byproduct bagasse(gross)			1.2E11			New	661.91	158.13	62522
23	Ethanol		3208	7.5200E10			New	661.91	158.13	88020
Money flows:										
24	Sales (domestic)	795.85			6.9E12			549.14	131.18	
25	Sales (foreign)	795.85			2.6E12			206.92	49.43	
0									0.00	
26	Economic subsidies	178.2			6.9E12			122.96	29.37	
0									0.00	

Table II

Ratios:		
	Net energy yield ratio:	
27	Sugarcane	1.0905
28	Ethanol	1.1424
0		
	Feedbacks per envir. input	
29	Agricult. produc	11.044
30	Ethanol	7.0232
0		
	Return for local sale:	
31	Ethanol	.82962
0		
0	Return, USA sale, 1980	
32	Ethanol	.31261
0		
	Return, USA sale, 1984	
33	Ethanol	.24768
0	Return, foreign sale-gasoline	
34	Ethanol	.91625
0		
0	Fuel prod. per fuel used:	
35	Ethanol	7.5977

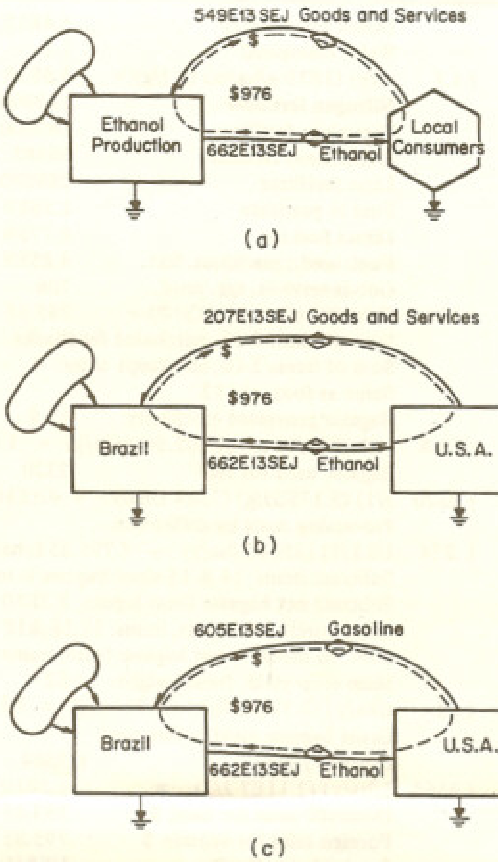

Figure 2

If alcohol is exported to a gasoline producing nation and the money is used to buy gasoline, Brazil receives 0.88/1 (footnote 34). Therefore, exporting alcohol to developed countries is a disadvantage to Brazil.

If, however, export was to a less development country (one with a higher embodied energy ratio to the international dollar) a better ratio was obtained for Brazil. For example, sale to Liberia gave a positive ratio to Brazil of 4.8 (footnote 36).

Benefits or losses from foreign trading of ethanol were inferred from ratios of embodied energy. See Fig. 2.

Comparison To Other Sugarcane-Alcohol Studies

A comparison of the results of this study with an energy analysis of a sugarcane-ethanol system in Louisiana, USA (11) shows several differences such as greater rainfall in Louisiana, more phosphorus needed in Brazil, much more fuel use in Louisiana, and much more human work in Brazil. In Brazil the process gives a small positive net energy yield ratio of 1.1; in the US the process breaks even with a ratio of 1.0; between 0.1 and 1.8 in Louisiana, depending on use of bagasse. Hopkinson and Day (7) calculated a net energy ratio for Brazil. A higher value was found by omitting energy of labor and fertilizers. If these energies were included, the ratio would be lower.

In the study carried in Brazil by Lima and Malavolta (9) the net energy ratio of a sugarcane-ethanol sustem was calculated as 2.4. However these authors also did not include the embodied energy of human services and fertilizers. If these energies were included, the ratio would be lower.

Footnotes

1		Direct solar energy	5.4E12	SEJ/ha/y	Ref:	CEPEC weather department
2		Water transpired	1.1	m/y	Ref:	P.T. Alvim, CEPEC
	(1.1	m/y) (1E10 g/ha/m) (5 J/g) =	5.5E10	J/ha/y		
3		Nitrogen fertilizer	118000	gN/ha/y	Ref:	urea, ammon, sulphate; (CEPLAC, 1984)
4		Potassium fertilizer	165000	gK/ha/y	Ref:	(CEPLAC, 1984)
5		Phosphorus fertilizer	66885	gP/ha/y	Ref:	(CEPLAC, 1984)
6		Lime fertilizer	289000	gCa/ha/y	Ref:	with 12600 gMg/ha/y (CEPLAC, 1984)
7		Fuel in pesticide	1.58E9	J/ha/y	Ref:	Herb. & insect. (Oldemberg. 1983)
8		Direct fuel use	6.77E9	J/ha/y	Ref:	tractors, trucks (Oldemberg, 1983)
9		Fuel: seed.; machines, fert.	4.85E9	J/ha/y	Ref:	(Oldemberg, 1983)
10		Goods-services, agr. prod.	706	$/t	Ref:	(Vargas, 1981; 55 Cr/1980 $)
	(706	Cr/t) (62 t/ha) / (55Cr/#) =	795.85	$/ha/y	Ref:	(Oldemberg, 1983)
11		Sum of items 3-10, purchased feedbacks				
12		Sum of items 2-10, all except solar				
13		Same as footnote 12				
14		Bagasse generated electricity	15.8	kw	Ref:	(Gemente, 1982); 2.5 t/hr
	(15.8	) (3.6E6J/kwhr) (1hr/2.5t) (62t/y) = 1.41062E9				
15		Bagasse used for fuel	2220	g/liter		(Gemente, 1983); 5.17E3J/g wet bagasse
	(2220	g/1) (5.17E3J/g) (3564 I/ha/y) = 4.1E10				
16		Processing costs by difference				(Goldemberg, 1983); 55Cr/1980 $
	(.274	US$/1) (3564 1/ha/y) – (795.85 $/ha/y) = 180.681				
17		Subtract items 14 & 15 since bagasse is in feedback use.				
18		Subtract net bagasse from inputs	7.3E10	J/ha/y	Ref:	(Goldemberg, 1983) potential use
19		Sum, purchased inputs, items: 11,16,&18				
20		Sum, all inputs – net bagasse (sum, items: 13 through 18)				
21		Main crop yield, fresh weight:	62	t/ha/y	Ref:	(Goldemberg, 1983); 0.3 dry/fresh
	(62	t/ha/y) (0.3) (1E6g/t) (16744 J/g) = 3.1136E11				
22		Gross bagasse yield before use:			1.2E11	
23		Ethanol yield	(3564	1/ha/y)	Ref:	(Goldemberg, 1983) 5050 kcal/l
	(3564	1/ha/y) (2.11E7 J/1) =	7.5E10			
24		Domestic sales for local $	795.85	US 1980 $ using local embodied energy/$ ratio		
25		Foreign sales for outside $	795.85	US 1980 $ using foreign embodied energy/$ ratio		
26		$ subsidy by Gov't	US$/1: .05		Ref:	(Goldemberg, 1983)
	(.05	$/1) (3564 1/ha/y) =	178.2			
27		Sugarcane yield/purchased feedbacks: item 20/item 11				
28		Ethanol yield/purchased feedbacks: item 22/item 18				
29		Environmental loading: item 11/item 2				
30		Environmental loading: item 19/item 2				
31		Embodied energy return on sale: ratio item 24/ item 23				
32		Embodied energy, foreign sale: ratio item 25/ item 23				
33		Embodied energy return on 1984 foreign sale; export price, $262.54 US/t (Banco, 1984)				
		Foreign sales for outside $	819.72	US 1984 $ using US embodied energy/$ ratio, 2E13 SEJ/$		
		Ratio = foreign sales/item 23				
34		Gasoline bought with ethanol $; gasoline price .33 1980 US $/liter				
		(3.81E7J/1) (6.6E4SEJ/J)/(.33) = 7.6E12 SEJ/$ of gasoline				
	Ratio =	(7.6E12SEJ/$) ($796/ha/y)/ 661.91SEJ/ha/y = .916253				
35		Liquid fuel used per fuel produced: item 23 / (items 7, 8 & 9)				
36		34.5 E12 SEJ/$ Liberia / 6.8 E12 SEJ/$ ethanol = 5.0				
37		gasoline 3 1/$, 2.5 E12 SEJ/1; Brazil: 6.9 E12 SEJ/$				
		Ratio = (3 1/$, (2.5 E12 SEJ/1)/6.9 E12 SEJ/$ = 1.1				

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EFEITO DO CONTEÚDO DE ÁGUA NA PERSISTÊNCIA DO DDT-^{14}C EM SOLO SOB CERRADO*

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ABSTRACTS. *Effect of water content on the persistence of ^{14}C-DDT in a soil under cerrado.* It was studied, under laboratory conditions, the influence of moisture on persistence and degradation of ^{14}C-DDT in a soil under "cerrado". Results showed that DDT still persisted in the Dark Red Latosol medium texture after one year, in spite of a tendency to be more persistent at 1/3 field capacity and less persistent at higher levels of moisture.

RESUMO. Estudou-se, em condições de laboratório, a influência da umidade na persistência e degradação do DDT-^{14}C em solo sob cerrado. Os resultados mostraram que o DDT ainda persistiu no Latossolo Vermelho Escuro textura média após um ano, a despeito da tendência maior da persistência a 1/3 da capacidade de campo e menor a níveis maiores de umidade.

INTRODUÇÃO

São raras as informações da meia-vida do DDT em solo sob condições tropicais (3). Sabe-se, entretanto, que em regiões de clima temperado esses níveis já foram bastante elevados e, representando perigo para a saúde humana, provocaram banimento do uso deste pesticida em território norte-americano há alguns anos (10) apesar de ainda se registrarem resíduos desse composto nos solos (2). No Brasil, alguns estudos já foram realizados e relatam alta sorção e ausência de movimento em solos dispostos em placas de camada delgada (8).

Conforme Edwards (3), quanto menor a dose, maior a perda desse pesticida principalmente em solos úmidos, sugerindo que o conteúdo de água pode influenciar a perda de DDT dos solos. Por outro lado, Lichtenstein e Schulz (7) relatam perda de 25% do DDT durante período de três meses, sendo que a persistência não foi afetada pela umidade do solo.

Lembrando-se também que nas regiões tropicais a umidade é um parâmetro importante a influenciar o comportamento de pesticidas no solo, iniciou-se uma investigação para determinar o efeito de diferentes teores de umidade na persistência do DDT em Latossolo Vermelho Escuro textura média sob cerrado.

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