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FERMENTATION ALCOHOL IN THE COMMONWEALTH CARIBBEAN *

by

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1.0 BACKGROUND

The Commonwealth Caribbean comprises a polyglot of islands which cover an arc some fifteen hundred miles or so from Miami in the north to Venezuela in the south. Two of the territories are non-island ones, situated on the mainland. These are Belize in Central America and Guyana in South America. The territories are conveniently divided into:

a) The MDC's (More Developed Countries): Barbados, Guyana, Jamaica, Trinidad & Tobago.

b) The LDC's (Less Developed Countries): Antigua, Belize, Dominica, Grenada, Montserrat, St. Kitts-Nevis-Anguilla, St. Lucia, St. Vincent.

Some salient features of the countries are summarised in Table I. Except for Guyana and Belize, the territories are relatively small and show a high density of population.

2.0 AGRICULTURE IN THE COMMONWEALTH CARIBBEAN

Patterns of agricultural production in the area were set in the colonial era and have remained relatively unchanged. There is a monoculture emphasis on crops for export to metropolitan markets. Except for Trinidad & Tobago, and to a much lesser extent, Jamaica, the economies of the islands are heavily oriented towards agriculture.

2.1 Land Use

Table II illustrates the land use in the territories under question. Much of the area is still classified as forested (61.1%), the major forests being found in Guyana (14×10^6 ha). The total land area under irrigation is only about 144,000 ha of which about 110,000 ha are in Guyana.

2.2 Sugar Cane

By far the major crop is sugarcane, being grown on approx 190,000 ha i.e. 15% of the arable land. Total sugarcane production is about 12,000,000 metric tons (1974) p.a., the largest producers being:

Guyana : 4.1×10^6 metric tons p.a.

Jamaica : 3.8×10^6 " " "

T'dad & Tobago 2.0×10^6 " " "

Barbados : 1.0×10^6 " " "

Average yields per ha range from 30-87 MT with an overall mean of 62 MT/ha. Total sugar production is about 1.0×10^6 metric tons p.a. of which the major part (>90%) is exported.

2.3 Rice

Rice is grown on about 118,000 ha (1974), total production being about

168,000 MT/p.a. By far, the largest producer of rice is Guyana (142,000 MT/p.a.). Yields approximate 1.3 MT/ha.

2.4 Grains (Maize)

Maize is grown to a greater or lesser extent throughout the region. Total area under maize (1974) is about 19,000 ha of which the greater part is in Belize (12,000 ha). Total production in 1974 was 41,000 MT i.e. a yield of about 1.7 MT/ha p.a.

2.5 Bananas

Bananas are grown on about 60,000 ha (1974) with about 30,000 ha in Jamaica, 8,000 in St. Lucia and 6,000 in Dominica. Production in 1974 was 256,000 MT.

2.6 Sweet Potatoes and Yams

In 1973, the total area under these crops was 18,892 ha of which 13,422 were in Jamaica. Production in that year was 16,500 MT i.e. a yield of about 8.7 MT/ha p.a.

3.0 THE ENERGY SITUATION IN THE AREA

The production of natural gas and crude petroleum occurs only in Barbados and Trinidad & Tobago. Production in both countries in 1977 was as follows:

	Natural Gas	Crude Petroleum
Barbados	419 x 10^4 m^3	5,208,000 BBL
Trinidad & Tobago	4,236.3 x 10^6 m^3	83,600,000 BBL

Production in Barbados is insufficient to meet local needs while production in Trinidad & Tobago is in excess of local needs. This is especially true of natural gas, for example, only 44% of the 1977 output was sold, the rest being flared. Trinidad & Tobago also has refining capacity much in excess of its requirements thus making the country a net importer of crude. Refineries also exist in Jamaica, Barbados and Antigua, but these service the local markets. Since 1976, the refinery in Antigua has been closed.

Table III shows the prices to the consumer of selected fuels in the area.

4.0 FERMENTATION ALCOHOL IN THE REGION

4.1 The Present Situation

Table IV summarises the statistics for rum and alcohol production in the region. The raw material used in every case is derived from sugarcane. In Antigua, Dominica, Grenada, St. Lucia and St. Vincent, the raw material is sugarcane juice while in the other territories, the raw material is molasses. Neutral blending spirits and 95% alcohol are produced in Barbados, Guyana, Jamaica and Trinidad & Tobago. Absolute alcohol is not produced in the region.

4.2 Plans for Fuel Alcohol

Faced by rapidly escalating import bills for fuel, galloping inflation, increasing balance of payment deficits and taking a cue from the Brazilian experience, both Guyana and Jamaica have commenced studies on the production of fuel alcohol from renewable resources. These are as yet studies but both countries have indicated plans to push ahead.

4.3 The Possibilities for and the Constraints Against Fuel Alcohol Production in the Region

i) Climatically, the region may not be ideal for agriculture, but it is satisfactory for growing certain carbohydrate-rich crops. There are high levels of insolation($\simeq$ 200 watts m^{-2}) throughout the year. For crops like sugarcane, the clear demarcation into a dry and wet season allows for ideal harvesting. During the active growing season, however, rainfall in some countries tends to be low and is far from optimal for rapid growth (rainfall varies from 64-432 cm p.a.)

ii) Topographically, except for Belize and Guyana, there is a limited amount of flat land available. Much of the area consists of steep slopes. Of the flat land that is available, a considerable part is already alienated to sugarcane and bananas.

iii) Geologically, the soils are developed from limestone, volcanic materials and alluvial deposits and may be regarded as being atypical for tropical soils. They are much younger than the normal tropical soils and have been considerably eroded, in many areas down to bare rock (Prof. N. Ahmad, personal comm.) The soils may generally be described as clays with impeded drainage.

iv) From consideration of the above factors, there is potential for expansion of sugarcane, cassava and other root crops. This potential is considerable particularly in reference to Guyana and Belize. In these two territories, because of the vast areas available, there is much room for development of mechanised agriculture.

v) Against this must be seen the fact that not only is the area a high-cost producer of agricultural raw materials but agricultural output is erratic as more and more of the region becomes enamoured of light manufacturing and assembly-type operations. Thus between 1965 and 1974 sugar cane production has fallen from 13,380,000 MT to 11,952,000 MT despite the fact that the land under cane has increased from 169,000 ha to 193,000 ha. Similarly, rice production over the same period has fallen from 182,000 MT to 168,000 MT. There has however been an increase in maize production from 13,500 MT in 1965 to 41,400 MT in 1974.

vi) A major constraint to the development of agriculture and better utilization of our resources is the lack of infrastructural development i.e. roads, water, electricity, communications, education and support services. The territories of the Caribbean except for Trinidad & Tobago are generally deficient in the amount of capital required for such infrastructural development. Despite this, though, it is imperative that capital be put into such development to stimulate agriculture and open up new agricultural lands.

vii) A constraint to be faced is the management, use and availability of human resources. The very areas with available large land resources i.e.Belize and Guyana are faced with vast shortages of manpower. In addition, one must consider the fact that in the colonial and post-colonial eras, people were de-motivated from agriculture for many reasons and this has led to mass rural migration to the urban areas. Positive mechanisms need to be developed to encourage movement to the rural sector. Agriculture will have to be developed as an industrial and technological sector which must be seen to be dynamic and progressive.

viii) Shortages of skilled personnel is a perennial problem. Generally speaking, the territories of the area do not provide fertile ground for the development of intellectual and academic pursuits. There are many very competent scientists, technologists and technicians from the area who reside and work in the developed countries. A consequence of this is that the few who remain find themselves having to deal with a range of problems thereby diluting their efforts. There are too few microbiologists, chemical engineers, mechanical engineers and biochemists working in the area.

ix) A part consequence of this is that there is little indigenous R & D of any consequence. There is not yet a political or cultural appreciation of the role that R & D plays in the development of society. The rum industry is the major fermentation industry, apart from brewing, and this is more of an art than a science. Microbial cultures, technology, know-how etc. for these industries are all imported. Quality control, process optimisation, technology adaptation, adequate technology screening are all done in a haphazard manner if at all.

x) Another factor that must be considered in the Caribbean context is the availability of natural gas rich in C_1 (94%) in Trinidad & Tobago. Proven reserves are currently believed to be 1.7×10^{11} m^3 while probable reserves are estimated at 3.4×10^{11} m^3. Production of natural gas in 1977 was 4.2×10^9 m^3 of which 1.9×10^9 m^3 was used. There is therefore considerable potential for conversion to methanol which can also be used in extending motor gasoline.

xi) There would appear to be little opportunity for fermentation alcohol as a chemical feedstock in the region in the immediate future. This is due to the fact that there are no chemical process industries except fertilizers now in existence in the region and none are contemplated in the near future.

5.0 CONCLUSIONS

Trinidad & Tobago in 1975 consumed 328,884,625 litres of motor gasoline. If we are to multiply this by four, we should probably arrive at a conservative estimate of the region's needs for motor gasoline i.e. about 13×10^8 litres. Assuming that 10% of this could be substituted for by fermentation fuel alcohol, there could be a requirement for *ca.* 1.3×10^8 litres of alcohol i.e. a saving of about 5,451,333 bbl. crude oil (assuming gasoline = 15%) valued at $US79,044,328 ($US14.50/bbl). This volume of alcohol can for instance be produced from 197,490 tons sucrose which would require about 40,000 ha of sugarcane. Given the climatic and geographical features of the region, the potential does exist for the manufacture of alcohol by fermentation, especially in the two larger territories i.e. Belize and Guyana. There are, however, major constraints to be considered particularly in respect to the mobilisation of human, physical and financial resources. There is also the possibility of methanol production from considerable reserves of natural gas in Trinidad & Tobago.

TABLE I

SOME CHARACTERISTICS OF THE COMMONWEALTH CARIBBEAN

TERRITORY	AREA (KM 2)	POPULATION	POP. DENSITY (SQ. KM-1)	PER CAPITA GDP ($US) p.a. 1977	MAIN AGRICULTURAL CROP
MDCs					
Trinidad & Tobago	5128	1,148,600 (1972)	224	2693	Sugarcane
Barbados	430	250,000 (1973)	581	1486	Sugarcane
Jamaica	11,424	2,000,000 (1972)	175	1158	Sugarcane
Guyana	214,970	800,000 (1973)	3.7	492	Sugarcane, rice
LDCs					
Antigua	442	65,000 (1972)	147	680	Sugarcane, cotton
Belize	22,963	130,000 (1973)	5.7	485	Sugarcane, citrus
Dominica	750	74,000 (1974)	99	306	Bananas, coconuts
Grenada	344	120,000 (1973)	349	287	Cocoa, bananas
Montserrat	101	12,300 (1970)	122	738	Cotton, food crops
St. Kitts-Nevis-Anguilla	352	35,000 (1970)	99	868	Sugarcane, cotton
St. Lucia	616	101,000 (1970)	164	436	Bananas
St. Vincent	388	90,000 (1970)	255	279	Bananas, arrowroot

Note: Per Capita GDP is at factor cost

TABLE II

LAND USE IN THE CARICOM AREA

Territory	Year	% of Total Land			
		Forest	Arable	Permanent Crops	Meadows/ Pastures
Antigua	1968	15.9	59.1	-	6.8
Barbados	1960	-	60.5	-	9.3
Belize	1968	46.4	1.1	0.9	0.8
Dominica	1968	46.7	13.3	9.3	2.7
Guyana	1972	65.9	3.8	0.1	11.3
Grenada	1967	11.8	5.9	41.2	2.9
Jamaica	1965	19.0	22.0	22.0	22.5
Montserrat	1973	40.0	10.0	-	10.0
St. Kitts-Nevis-Anguilla	1970	16.7	22.2	16.7	2.8
St. Lucia	1966	21.0	17.7	16.1	4.8
St. Vincent	1970	41.2	41.2	11.8	2.9
Trinidad & Tobago	1963	45.2	11.1	16.0	1.2
Average		61.1	4.8	0.7	10.5

Source: FAO Production Yearbook 1974 and

Agricultural Statistics of the Caribbean Territories (ECLA) 1976

TABLE III

PRICES OF SELECTED FUELS IN THE COMMONWEALTH CARIBBEAN
($US/IMPERIAL GALLON)

TERRITORY	GASOLINE		DIESEL	#6 FUEL OIL
	REGULAR	SUPER		
Antigua	N.A.	1.06	0.87	N.A
Barbados	N.A.	1.46	0.96	0.71
Belize				
Dominica	N.A.	1.06	0.86	0.67
Guyana	1.16	1.27	0.61	0.49
Grenada	N.A.	1.05	1.00	N.A.
Jamaica	2.42	2.50	0.94	
Montserrat	N.A.	0.93	0.76	N.A.
St. Kitts-Nevis-Anguilla	N.A.	1.04	0.93	N.A.
St. Lucia	N.A.	1.02	0.89	N.A.
St. Vincent	N.A.	1.05	0.78	N.A.
Trinidad & Tobago	0.30	0.40	0.30	13

TABLE IV

PRODUCTION OF RUM

TERRITORY	YEAR	AMOUNT
Antigua	1976	178,000 Proof Gallons
Barbados	1977	2,344,000 Proof Gallons
Belize	1974	23,000 Liquid Gallons
Dominica	1976	133,000 Proof Gallons
Guyana	1977	3,500,000 Proof Gallons
Grenada	1977	87,000 Proof Gallons
Jamaica	1977	3,900,000 Proof Gallons
Montserrat		N.A.
St. Kitts-Nevis-Anguilla		N.A.
St. Lucia	1977	203,000 gallons
St. Vincent	1977	93,400 gallons
Trinidad & Tobago	1977	4,225,000 Proof gallons

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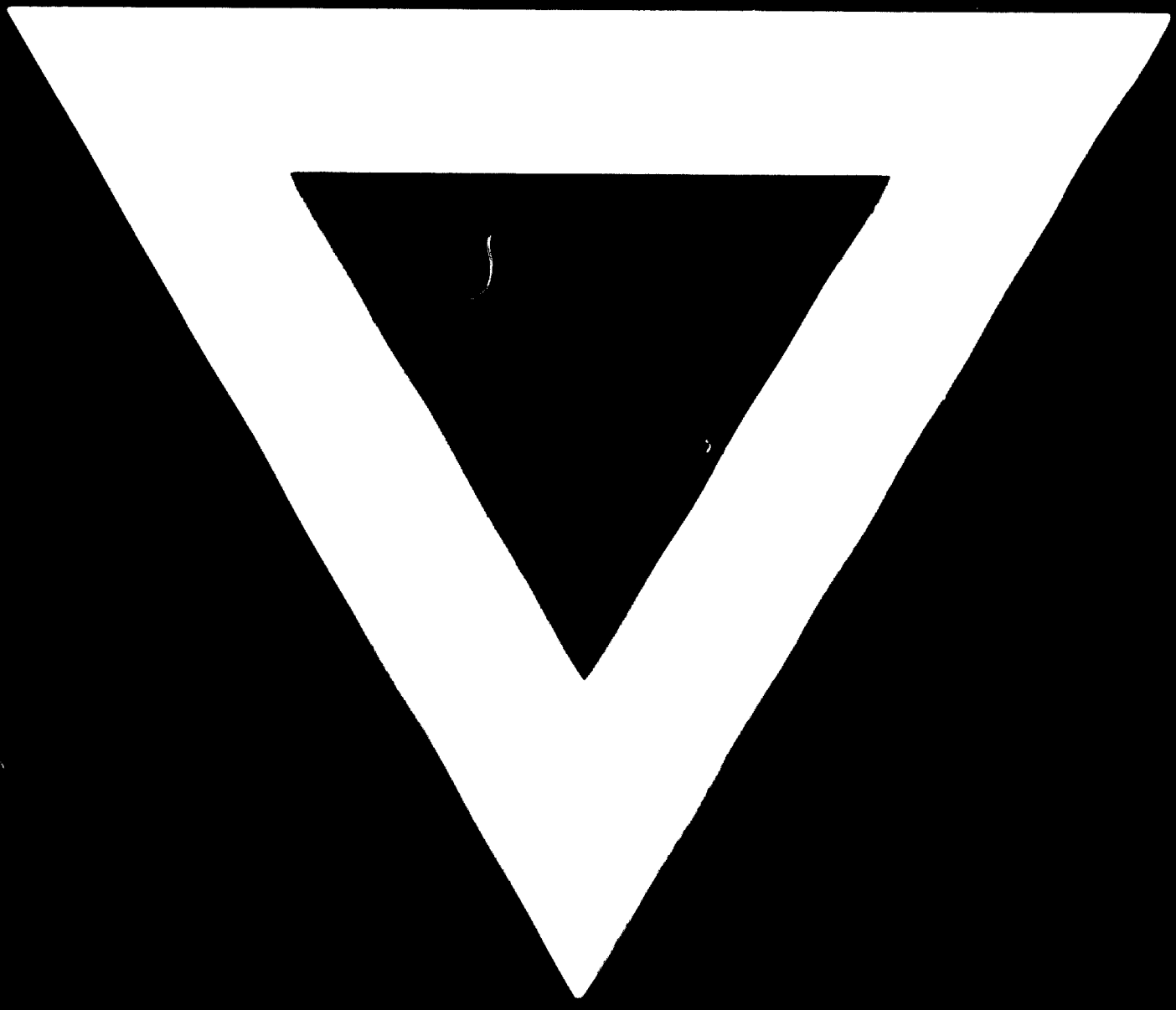

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