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CARIBBEAN FOOD CROPS SOCIETY

40

Fortieth

Annual Meeting 2004

LAND USE PLANNING FOR AGRICULTURAL DIVERSIFICATION OF SUGAR ESTATES IN TRINIDAD AND TOBAGO

Seunarine Persad. Soil and Land Capability Unit, Research Division, Ministry of Agriculture, Land and Marine Resources, Centeno, Trinidad

ABSTRACT: Restructuring of the sugar industry in Trinidad and Tobago has released 12,158 hectares of sugarcane lands for agricultural diversification. Caroni (1975) Limited, a state enterprise sugar company controls 31,000 hectares, representing 25% of the best available arable lands in the country. Soil, land capability and agro-ecological analyses conducted on Caroni (1975) land holdings indicate that 67% of the lands are in Class III and IV, representing good agricultural lands with moderate soil fertility, and 33% of the lands are in Class V, VI and VII, depicting marginal agricultural lands. Continuous sugarcane production with sub-optimal soil fertility management programmes has resulted in soil nutrient and organic matter depletion of lands, soil acidification, and land degradation with a consequent reduction in agricultural productivity. The technical and operational considerations for proposed diversification programmes to root crops, rice, vegetable crops, tropical fruits and livestock in relation to water management, soil technology for heavy clays, crop selection, farmer training, extension, credit and support systems are presented. The implications for food and nutrition security, and sustainable production systems in Trinidad and Tobago are highlighted.

Key words: Agricultural diversification, Soil management, Land degradation, Crop selection

INTRODUCTION

Since 1978, there has been a plethora of well documented studies of initiatives in Trinidad aimed at restructuring Caroni (1975) Limited into a viable agro-industrial company. The major component of these initiatives mandated Caroni (1975) Limited to organize and deploy its human, financial and physical resources, which are of strategic importance to national agricultural endeavor, to operate a viable diversified agricultural enterprise. However over time, attempts at restructuring Caroni (1975), including sugar operations and diversification into rice, beef, dairy, citrus and coffee have met with limited success, and have not reduced the dependence on state subventions to cover operating costs.

Caroni (1975) Limited through land acquisitions control 31,000 hectares, which represent 25% of the best arable lands in Trinidad. The company up to 2003 utilized 19,640 hectares in sugarcane cultivation both estate and rented to farmers, and 6,400 hectares in crop diversification projects. In 2003, the Government of Trinidad and Tobago, against a background of continuing operating losses, undertook a restructuring of the sugarcane industry, which entailed the cessation of sugarcane cultivation by Caroni (1975) Limited, the downsizing of the sugar industry to 75,000 tonnes, and the voluntary separation of 9,204 daily and monthly paid employees. The framework also mandated the operation of one sugar factory, the production of cane by farmers only with payment based on quality, and the establishment of an Estate Management and Business Development Committee to strategically develop and optimize the land assets of Caroni (1975) Limited. This restructuring exercise has resulted in 12,158 hectares

of Caroni Lands being available for diversified agricultural production, other than sugarcane production.

For most of its history Trinidad and Tobago has devoted the majority of its agricultural resources to producing export commodities principally sugar, cocoa, coffee, citrus and copra. Export agriculture was facilitated by institutional support and preferential marketing arrangements. The Agriculture sector contributed 115 M USD or 1.2% of the GDP (2002), but employs 37,000 or 7.2% of the national labour force. Trinidad and Tobago is a net importer of food, with importation of 267 M USD in 2002. The chief components of these imports are cereals (53.4 M USD); fruits and vegetables (50.9 M USD); animal feeding stuff (23 M USD); dairy products and eggs (44.7 M USD); meat and meat products (21.5 M USD).

The Caroni transformation process provides opportunity for new development options in areas such as nutrition and food security, agro processing, livestock development and environmental protection on strategically important land resources.

METHODOLOGY OF LAND EVALUATION

Caroni (1975) Limited, through acquisition and consolidation of estates, controls an estimated 31,000 hectares in Central and South Trinidad (Figure 1). These lands represent 7% of the land area of the country but approximately 25% of the best arable lands and hence are of strategic importance to agricultural development.

The acreages, physiographic features and historical land use allocation were reviewed on the basis of section maps, notated cadastral sheets and voluminous land record files. These land records were evaluated and reviewed by examination of aerial photographs and photomosaics for the years (1966, 1980, and 1998) to determine physiographic features, soil boundaries and land use.

A comprehensive soil survey review was undertaken in 2003 to evaluate soil and land characteristics which have potential impact on agricultural transformation. The principal land characteristics of interest included soil fertility constraints, soil erosion risks, soil salinity and land degradation hazards. Soil survey records and, Caroni (1975) Limited technical and research reports, were compiled and analyzed. Sampling and consolidation of data was undertaken to eliminate land data gaps within the sixteen land sections.

A crop suitability analysis was conducted using the crop environmental requirements database (FAO, 1979); soil suitability guidelines for major tropical crops (FAO 1984) and guidelines for land evaluation for rain fed and irrigated agriculture (FAO 1980, 1985).

Lands were categorized within the Trinidad and Tobago Land Capability Survey Protocol (1974), a quantitative land evaluation system with seven land capability classes. Additional subclass descriptions were defined to permit analysis of land use restrictions due to water availability, toxicity, erodibility, land leveling, drainage and irrigation, nutrient availability, soil acidity, compaction/ soil resistance, opportunity days, infield trafficability and accessibility and land clearing.

The digital land database of Caroni (1975) Limited was consolidated, validated and transformed using Arc View GIS, to enable proper geo-referencing of Caroni Land Sections. The Soil and Land Capability attributes from the soil surveys were integrated and analyses performed to determine land capability, crop suitability and land use.

DISCUSSION

Land Capability Analysis

The Trinidad and Tobago land capability survey protocol (1974) classifies lands in seven classes based on soil physical, chemical and mineralogical properties and site characteristics. Class I represents the best agricultural lands with a gradation to Class VII representing the lands best suited to forestry or environmental protection. The land capability distribution of Caroni (1975) Limited land holdings is presented in Table 1. There are no Class I and minimal acreages of Class II lands.

Class III represents relatively good soils, suitable for cultivation with intensive practices. Specific management practices related to water availability, amelioration of soil physical properties and soil acidity. These land comprising 9,917 hectares or 31.9% of total acreage were allocated a high priority for agricultural utilization, since the key soil series represented have a high agricultural potential for the production of a wide range of agricultural crops. These series include the Sevilla, Freeport, L'Ebranche, Cunupia and Waterloo soil series.

The area represented by Class IV lands is 10,931 hectares or 35.3% of acreage. Class IV represents agricultural lands, requiring intensive management with subclass limitations of adverse soil water relations and soil fertility. Distinctive soil series represented include the Bejucal and Frederick clays which are imperfectly drained, and the Mc Bean and Washington which are free draining soils, with good chemical properties.

Class V, represent principally lands on undulating topography, prone to soil movement, erosion, infertility and poor water relations. Most of the soils are, vertisols, existing on slopes 5 – 20° and have supported sugarcane cultivation for over 200 years. The acreage is 9009 hectares or 29.6% of land holdings.

Caroni (1975) Limited has very limited acreage of Class VI and VII soils. These lands are used for quarry, pasture or environmental protection.

Land Use Analysis

Agricultural operations of Caroni (1975) Limited were conducted in 2003 on 24,347 hectares representing 78.5% of total land holdings. Sugarcane cultivation on company lands and rented to farmers engage 19,640 hectares, while citrus, rice and other diversification projects occupied 4,700 hectares (Table 2). Significant non agricultural allocations include residential and housing estates, industrial sites, access roads and community facilities adjacent to sugar estates.

Proposals for potential agricultural land use allocations, consequent to the downsizing of the sugarcane industry in 2003, were formulated on the basis of land capability, soil suitability and strategic impact on food and nutrition security. The analysis indicated that 21,040 hectares have above average agricultural potential and can be retained for agriculture. Sugar cane cultivation exclusively by farmers can continue on 7,480 hectares. Food crops, vegetables, rice and tree crops are recommended to be allocated 10,027 hectares, while livestock production including beef, buffalypso, dairy and small ruminants are allocated 3,530 hectares (Tables 3, 4)

A significant feature of the proposed land use allocation is that diversification projects will be executed on the heavy clay soils of North and Central Trinidad. A detailed assessment of land use restrictions on Caroni (1975) land sections is presented in Table 5. Eleven land

characteristics were evaluated and the analyses indicate that the most severe restrictions to agricultural development include, water management (87.0%), drainage and irrigation infrastructure (80.2%), soil acidity (56.8%), nutrient availability (45.0%) and soil compaction/resistance (34.3%)

Water management and drainage and irrigation infrastructure are key factors in the transformation of lands from sugar cane to food crop production, since they will influence the number of crop cycles per year, choice of crops, crop scheduling, agronomy and hence farm profitability. Additionally amelioration of soil acidity consequent to high Urea use and unbalanced sugar cane fertilization will be a significant challenge to farm managers.

A significant acreage of lands, estimated at 7,000 hectares, is reserved for the development of small farmer plots, allocated to former Caroni (1975) employees, terminated as a result of restructuring of the sugar industry. These farmers will be engaged principally in the cultivation of vegetable and food crops. The land characteristics mandate that comprehensive training of farmers in crop production is a critical success factor. Additionally technical support in water management, extension, agriculture credit and soil testing advisory services are highly recommended for implementation.

Implications For Food Security

The Agriculture Sector Reform Programme 2003, provides a framework for greater agricultural production, and a sector which creates self sufficiency in food supply, generates employment, promotes food and nutrition security, reduces the rural to urban migration, and is ecologically sustainable. The agricultural diversification of sugarcane lands is structured in a framework of food production in strategic sectors of food, root crops, vegetables, tropical fruits, legumes and small ruminants. These commodities have been identified and proposed for development as profitable alternatives to utilize the resources currently devoted to sugar cane farming.

Food and Nutrition security policy is based on three components; food availability, food accessibility and household nutrition. The capacity of Trinidad and Tobago to provide adequate amounts of domestic food are a key determinant of food security, and has to be addressed adequately and systematically in agricultural policy formulation. The diversification of Caroni (1975) Limited provides an opportunity to target food production activities to ensure food availability food accessibility and household nutrition security in Trinidad and Tobago.

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ACKNOWLEDGEMENTS

The author gratefully acknowledges the assistance provided by the Technical Centre for Agricultural and Rural Cooperation ACP-EC (CTA), the Caribbean Agricultural Research and Development Institute (CARDI) and the Research Division, Ministry of Agriculture, Land and Marine Resources, Trinidad and Tobago (MALMR). This assistance enabled presentation of this paper at the 40th Annual Caribbean Food Crops Society (CFCS) Meeting: St John, US Virgin Islands, July 19th -23rd, 2004.

Table 1. Land Capability Classification Caroni (1975) Limited

Land Capability Class	Acreage (ha)	%
Class II	38	0.1
Class III	9,917	31.9
Class IV	10,931	35.3
Class V	9,009	29.1
Class VI	1,079	3.5
Class VII	27	0.9
	31,003	100.0

Table 2. Overview of Existing Agricultural Land Use Allocations Caroni (1975) Ltd.

Type of Activity	Hectares	Percentage
Sugarcane (Estate)	15,234	62.6
Pasture	595	2.4
Citrus	1,367	5.6
Wine Making	182	0.7
Rice and Other Food Crops	2,038	8.4
Tree Crops	410	1.7
Aquaculture	115	0.5
Cane Farming	4,406	18.1
Total (78.5% of total acreage)	24,347	100.00

Table 3. Land Use Allocation By Agricultural Activity Types on Caroni (1975) Ltd.

No.	Type of Activity	Hectares	Percentage
1.	Sugarcane	3,076	14.6
2.	Food Crops	2,845	13.5
3.	Rice	3,019	14.3
4.	Livestock	2,246	10.7
5.	Vegetables and Food Crops	1,125	5.3
6.	Citrus	1,093	5.2
7.	Tree Crops	850	4.0
8.	Buffalypso	597	2.8
9.	Forestry	577	2.7
10.	Vegetables	445	2.1
11.	Diary	405	1.9
12.	Small Ruminants	283	1.3
13.	Cocoa	73	0.3
	Subtotal	16,634	79.1
	Rental (Cane Farmers)	4,406	20.9
	Total (67.9%)	21,040	100.0

Table 4. Proposed Agricultural Land Use Caroni (1975) Ltd.

No.	Section	Total Acreage (ha)	Proposed Activity	Land Class Capability	Proposed Acreage (ha)
1.	Caroni	2343	Vegetables and Food Crops Rice	II, IV III, IV	320 1400
2.	Orange Grove	1519	Vegetables and Food Crops	III	299
3.	Jerningham	1229	Vegetables Rice Food Crops	III, IV III III, IV	223 445 198
4.	Todds Road	970	Citrus Tree Crops	III, IV, V III, IV, V	486 121
5.	Edinburgh	1401	Food Crops Dairy Farms	III, IV III, IV	627 405
6.	Felicity	1528	Rice Food Crops Vegetables	III, IV III, IV III, IV	708 192 223
7.	Waterloo	1383	Food Crops Rice	III, IV III	506 465
8.	Exchange	1603	Vegetables and Food Crops Sugarcane (estimated)	III III, IV	506 567
9.	Montserrat	1687	Food Crops Tree Crops Forestry	III, IV, V IV, V, VI V, VI	127 728 71
10.	Esperanza	1281	Small Ruminants Food Crops Forestry	IV, V, VI IV V, VI, VII	283 304 142
11.	Reform/ Williamsville	2346	Food Crops Sugarcane (estimated)	III, IV III, IV, V	607 809
12.	Cedar Hill	989	Sugarcane (estimated)	IV, V, VI	728
13.	Petit Morne	1765	Sugarcane (estimated)	III, IV, V	809
14.	La Fortune 1 & 2	1913	Livestock (beef) Sugarcane (estimated)	III, IV, V III, IV, V	1174 162
15.	La Gloria	1838	Citrus Livestock Food Crops	IV, V, VI IV, V, VI IV, V	607 1072 81
16.	Forres Park	1011	Forestry Food Crops	V, VI, VII II, IV, V	506 202
17.	Mora Valley	670	Cocoa Buffalypso	III, IV III, IV	73 597
	Total	25476			

Table 5. Land Use Restrictions: Caroni (1975) Limited Land Sections.

Restrictions	Hectares	%
Water Management	26,970	87.0
Toxicity/ Salinity	1,178	3.8
Erodability	6,107	19.7
Drainage and Irrigation Infrastructure	24,862	80.2
Nutrient Availability	13,950	45.0
Soil Acidity	17,608	56.8
Compaction/ Soil Resistance	10,633	34.3
Land Clearing	2,542	8.2
Land Leveling	837	2.7
In Field Trafficability	1,116	3.6
Opportunity Days	8,339	26.9

