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**“Reality and Potential of Food Security and Agricultural Diversification in
Small Island Developing States”**

**“Realidad y Potencial de la Seguridad Alimentaria y la Diversificación
Agrícola en Pequeños Estados Insulares en Desarrollo”**

**“Sécurité alimentaire et diversification agricole dans les petits états
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FOOD CROP PRODUCTION AND LAND MANAGEMENT FOR CARONI (1975) LIMITED '2 ACRE FARMS' IN TRINIDAD AND TOBAGO

*Seunarine Persad*¹, *Ian Rampersad*² and *Ramgopaul Roop*³. ¹University of Trinidad and Tobago Corinth (seunarine.persad@utt.edu.tt) ²Research Division, Ministry of Agriculture, Land and Marine Resources (SOILS_DEPT@yahoo.com), ³TTABA Tunapuna

ABSTRACT: Establishment of crop and livestock farms, including 7,800 '2-acre' farms and 16 large farms, on Caroni (1975) Ltd extensive sugar cane land holdings, is a key agricultural diversification policy initiative in Trinidad and Tobago. The development objective is the sustainable management of strategic agricultural land resources for increased food production, employment and food security. Field surveys conducted in 2008/2009 indicate that < 5% of 2-acre plots developed were occupied and < 3% engaged in productive agriculture, although high land development expenditure was incurred. Soil and land use investigations and analyses of the '2-acre' farms, conducted island-wide, confirm that agricultural utilization is adversely influenced by a range of technical and socio-economic constraints, including, inter alia, impoverished, acidic, heavy clay soils; inadequate drainage, insufficient irrigation and poor access infrastructure; land clearing, tillage and soil amelioration challenges; lack of technical and related extension support; and limited farmer training, knowledge and expertise in intensive soil and crop management. The '2-acre' farm model as proposed is not feasible as a production unit and has minimal impact on national food production and food security. An advanced integrated land use model (TTABA Model) is designed to mitigate the technical and socio-economic constraints while increasing sustainable production of strategic food commodities – sweet potato, cassava, bananas, vegetables, legumes and tropical fruits- and while utilizing 7,400 hectares of former sugar cane lands. The TTABA model proposes consolidation of '2-acre farms' into discrete land management units, based on land capability criteria, and supported with the technical and financial resources to improve soil management, tillage, irrigation, agronomy, post-harvest quality, financing and market requirements for effective diversification to sustainable food production farms.

Keywords: Agricultural diversification, Crop production, Land management, Land use models

INTRODUCTION

Establishment of crop and livestock farms, including of 7,830 2-acre farms and 16 mega farms on Caroni (1975) Limited former sugar cane lands, is a key agricultural policy initiative of the Government of Trinidad and Tobago (GOTT). The principal objectives of this policy were identified as the enhancement of domestic food production, the generation of agricultural activity in rural communities, sustainable management of land resources, and the provision of national food security.

Caroni (1975) Limited, a sugar-based agro industrial state company in Trinidad and Tobago, terminated its core business activity of sugar production in 2003. Employees were allocated 2-acre land parcels to engage in a wide range of agricultural enterprises, and approximately 7,800 applicants were assigned plots (Table 1). These plots were surveyed, excised from sugar cane land sections island-wide, and provided with basic infrastructure, limited to rudimentary access roads and perimeter field drains.

The Estate Management and Business Development Company (EMBD) was assigned responsibility for land surveys, plot identification and demarcation, infrastructure development,

and project management. The Ministry of Agriculture, Land and Marine Resources (MALMR) assumed responsibility for farmer training, registration, definition of agricultural leases and coordination of inter agency technical support including public utilities, agricultural credit and marketing.

Field surveys by the Soil and Land Capability Unit in 2008 indicated that <5% of 2-acre plots were occupied and <3% engaged in productive agriculture, with occupancy rates on the Naparima peneplain, South Trinidad, even less than the national average land utilization. The infrastructure development, land allocation, and land utilization initiatives have not progressed satisfactorily. After five years, the agricultural development objectives of the 2-acre farm programme have not been achieved.

Farmers who attempted to cultivate assigned plots were confronted by a range of technical and socio-economic constraints. Technical constraints included inadequate land clearing and development, impoverished acid soils, rudimentary access roads, inadequate infield drainage for heavy clay soils, and an absence of irrigation facilities. Socio-economic constraints included lack of technical support, uneconomic farm size, limited agricultural knowledge, and distance of plots from farmer residences.

METHODOLOGY

The methodological framework for the development of an agribusiness plan for Caroni (1975) Limited '2-acre' farms was formulated by an objective assessment that recipients of plots were not technically equipped to manage agronomy on heavy clay soils with limited agricultural infrastructure, and consequently they will be amenable to developing strategic partnerships for land utilization. TTABA has an inherent capacity to provide technical and agri-managerial skills in land development and engineering, agronomy, marketing, processing and training. Production efficiency would be enhanced through crop zoning and scheduling, rationalization of machinery and equipment use, production and marketing scheduling, and sustainable development of the soil and water resources.

The framework comprises the following elements:

- (a) Acquisition of reports, maps, survey plans detailing topography, soil, land capability and land distribution status of 30 sites allocated for '2-acre' farms.
- (b) Examination and evaluation of review of technical reports and studies commissioned to determine use of Caroni (1975) Limited land assets.
- (c) Site visits to evaluate present land use programmes and status of infrastructure projects.
- (d) Determination of enterprise suitability recommendations through analysis of land characteristics, crop suitability protocols, national food security policy, and TTABA production requirements.
- (e) Compilation of reports and recommendations. These proposals were developed over the period November 2008 to January 2009.

DISCUSSION

ANALYSIS OF CONSTRAINTS INFLUENCING '2-ACRE' FARMS

The soil fertility and water management characteristics of Caroni (1975) Limited lands allocated for 2-acre farms were evaluated by soil surveys and field investigations supplemented by chemical and physical laboratory analyses by Persad et al. (8) in 2006 and 2007. Eight land use constraints including requirements for extensive land clearing and leveling; absence of irrigation infrastructure; high soil acidity < pH 4.5; low nutrient NPK levels; high lime requirement for vegetable production and intractable soil physical properties were identified and quantified (Table 2). Soil amelioration, nutrient management, tillage, drainage and irrigation were

assessed as critical factors influencing the development of 2-acre farms. Investigations conducted in 2009 confirmed that the development proposals for 2-acre farms were limited as to access roads and perimeter drainage channels. Structured development projects essential for agricultural utilization of the plots were not listed in the documentation profiles.

A major constraint to sustainable agricultural development on 2-acre farms is the absence of development plans to provide irrigation water supplies. Rain-fed agriculture restricts the selection of crops, with consequent reduction in acreage cultivated and production targets. Collection and storage of irrigation water supplies within a two-acre land holding will constrict the already limited sound agricultural acreage. A land consolidation model will enable the planning and implementation of regional irrigation projects with a capacity for a range of water delivery systems consistent with crop programmes.

Table 1: Allocation of 2-acre Caroni (1975) Limited Farms by Sections

Section	Acreage (ha)	No. of Plots
Caroni	316	260
Orange Grove	100	104
Jerningham	260	271
Edinburgh A, B	700	690
Felicity 1, 2	620	655
Waterloo 1, 2	644	672
Exchange 1, 2	920	1,261
Montserrat A, B	370	385
Reform/ Williamsville A, B, C, D	600	732
Petite Morne	660	722
La Fortune	940	940
La Gloria	340	340
Cedar Hill	600	725
	7,390	7,757

Table 2: Land Quality Restrictions on Caroni (1975) '2-acre' Farms

Restriction	Acreage	%	Main Sections
Inadequate Drainage	4,950	67	Caroni, Waterloo, Exchange, Edinburgh, Felicity
Irrigation (Absence)	6,500	88	All Sections
Soil Acidity, pH < 4.5	4,200	57	Jerningham, Exchange, Waterloo, Felicity
Erosion > 50% topsoil loss	1,480	20	La Gloria, Cedar Hill, Petit Morne, Picton
Compaction	2,585	35	Jerningham, Caroni, Edinburgh
Low Nutrient Availability	5,620	76	North and Central Sections
Land Clearing, leveling	6,950	94	All Sections
Adverse Soil Physical Properties	5,320	72	Central and South Sections

TABLE 3: ACIDITY LEVELS IN CARONI (1975) LIMITED SECTIONS

Section	Acreage Sampled (ha)	Mean	Range
Edinburgh	190	4.59	3.50 – 5.40
Jerningham	150	4.08	3.50 – 5.06
Exchange	230	4.11	3.52 – 5.63
Caroni	230	4.19	3.64 – 4.28
Felicity	240	4.48	4.13 – 5.36
Waterloo	260	4.09	3.70 – 5.73
Montserrat	20	4.36	4.13 – 4.62

High soil acidity levels on Caroni (1975) Limited land in North and Central Trinidad result from high use of urea and unbalanced fertilizer practices. Soil pH levels (Table 3) range from pH 4.3 to 5.0, with low cation exchange capacity and low nutrient levels. The unavailability of quality limestone supplies for soil amelioration results in the limited choice of crops with high aluminum tolerance including cassava, pumpkins and sorrel. Caroni (1975) Limited soils require a high level of technical soil management to ensure profitability.

Soils in South Trinidad reflect significant exposure of subsurface marls in Cedar Hill, Petit Morne and Williamsville sections. These exposures are influenced by soil erosion and slumping, especially on undulating topography, and indicate accelerated erosion from poor tillage and land preparation practices. Management of soil chemical relationships in all sections will require frequent soil testing, diagnoses and fertilizer recommendations. The alternative will be high fertilizer input, limited crop selection and low crop yields.

Development of TTABA Model

The Trinidad and Tobago Agri-business Association (TTABA) is a private company, established to facilitate the planning and development of the local agri-business sector. TTABA has the responsibility of implementing the GOTT-funded National Agri-business Development programme (NADP), which has both developmental and commercial agricultural components.

The developmental components are aimed at establishing and supporting community and farmer associations, community industry associations and at facilitating research to support targeted commodities. The commercial components involve contract production with farmer associations and large farms, establishing new agro-processing facilities, and the producing and marketing of new value added food, feed and non-food products from agricultural produce.

The development of production farms on Caroni (1975) Limited land allocated for 2-acre farms is considered important for implementation of TTABA business development strategy. The Caroni land resources are strategically located in relation to agronomy and agri-business development. An objective assessment indicated that recipients of plots are not technically equipped to manage agronomy on heavy clay soils with limited agricultural infrastructure, and ensure sustainable production of commodities required for agri-business development.

The SWOT analyses conducted as part of this study indicate that partnerships will mean the establishment of large farm units (> 100 ha) through consolidation of 2-acre plots into technical and economically feasible units. Development of these strategic partnerships with recipients will result in greater land utilization consistent with GOTT and TTABA policy.

TTABA has an inherent capacity to provide the technical and agri-business managerial skills in land development and engineering, agronomy, processing and marketing. Production efficiency and sustainability will be enhanced through crop zoning and scheduling; rationalization of machinery and equipment use; production and marketing services, and national development of soil and water resources. Additional to the technical constraints of land management, many recipients have opted not to utilize the lands for reasons ranging from lack of funds for investment, lack of interest in agriculture, distance of plots from residence and threats of praedial larceny. Survey data also indicated that 46.1% of recipients are more than 60 years old with minimal interest in agriculture with a high labour component.

The TTABA land utilization model were developed on the basis of an analysis of soils, land capability and crop production protocols, especially for rain-fed agriculture in tropical environments (3). Also evaluated were strategic enterprises including tree crops, root crops, aquaculture, small ruminants, and legumes consistent with soil and land capability studies on Caroni lands (4) and TTABA agri-business projections (9).

The TTABA model includes allocations for specific business units. The allocation and five-year development schedule is presented in Tables 4 and 5. The schedule proposes cultivating 5,668 hectares with a contingency allocation of 20% of land allocated for infrastructure development and environmental protection. The projected allocation is tropical fruits and tree crops (50%); herbs and spices (0.3%); staples –root crops and vegetables (26%); livestock and aquaculture (20%). The projected production volumes of farm output are presented in Table 6. Detailed analyses indicate that the projected production volumes are consistent with TTABA strategic food production initiatives for agro-processing, agri-business development and national food security (9). Additionally there is a significant potential for increasing rural employment and revitalizing the agricultural sector in Trinidad and Tobago.

Critical factors influencing the implementation of the TTABA model include a specific research support service, especially soil and crop protection management, marketing support (NAMDEVCO), Agriculture credit (ADB) and public utilities. The involvement of regulatory agencies (EMA) and inter agency coordination is a key factor in ensuring national support in the food security initiative proposed.

The consolidation of 2-acre plots into technical and economic management units is advanced. Allocation of consolidated parcels to specific crops on the basis of soil, topography and land capability analyses is a distinctive factor in sustainable land resource management. Critical for success at the operational level are these factors: the effective use of equipment and machinery resources for farming heavy clay soils, and the application of structured agronomic programmes in cultivation, fertilization, drainage, irrigation, soil conservation and integrated pest management.

**Table 4: Land Use Recommendation Caroni '2-acre' Farms
Land Use/ Section Matrix**

	C	OG	JJ	ED	F	W	EX	M	R/W	PM	La F	La G	CH	Total *	Remarks
Crops															
Sweet Potato	50		200	300	150	150	200				200		100	1,350	
Cassava						150	200	100	200	100	200		100	1,050	
Plantain/ Banana			60			50	50		50			100		310	
Corn															
Vegetable	200	100		150	50	50	50			100	100		100	900	
Small Ruminant				100	60			100	100	50	50	50	150	660 *	
Coconut						50	50	100	50	50	50	50	50	450	
PommeCythere				100	100	100	100	70	50	100	50		100	770	
Fruit							200			150	150	140		640	
Dry Legume	60			50					150		50			410	
Aquaculture					100	100								200	
Other Root Crops					150					100	100			350	
Allocated (Acres)	310	100	260	700	610	650	950	370	600	650	900	300	600	7,090	
Allocated Acreage	316	100	260	700	620	651	920	370	600	660	940	340	600	7,390 **	

Key :

C	-	Caroni		W	-	Waterloo		La F	-	La Fortune
OG	-	Orange Grove		EX	-	Exchange		La G	-	La Gloria
JJ	-	Jerningham Junction		M	-	Montserrat		CH	-	Cedar Hill
ED	-	Edinburgh		R/W	-	Reform/ Williamsville	*	Hectares		
F	-	Felicity	PM	-	Petite Morne		**	Excludes Infrastructure Allocations		

Table 5: Crop Production Schedule 2-acre Farms TTABA Model

Business Units	Hectares	Total (%)	Planting Schedule (Ha)				
			Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Fruits							
Golden Apple	405	7	50	139	228	317	406
Papaya	81	1	10	20	40	60	81
Citrus	405	7		100	200	300	405
Coconut	810	14		200	400	600	810
Noni/ Soursop/ Wl Cherry	405	7		50	100	200	405
Melons (Watermelon/ Cantalope H.D.)	121	2	20	40	60	80	121
Oils and Fats							
Ackee/ Avocado	607	11		100	200	400	607
Herbs and Spices							
Lemon Grass	121	2	20	40	60	80	121
Shadow Beni	81	1	10	20	40	60	81
Staples: Root Crops and others							
Eddoes	202	4	25	50	100	150	200
Sweet Potato	607	11	100	200	400	600	729
Plantain	243	4	50	100	150	200	243
Topi Tambu	202	4	50	75	100	150	202
Corn	202	4	50	100	150	202	202
Vegetables							
Legumes							
Red Bean and Black-Eye Bean	20	0.36	20				
Food from Animal Sources							
Dairy	202	3,057		25	50	100	202
Rabbits	61	1.07	10	20	30	40	61
Tilapia (Tank Production)	20	0.36		5	10	15	20
Goat Milk (Semi Intensive)	20	0.36		5	10	15	20
Agro-Tourism Ent. Soil Sust							
Fallow ha (pasture & fallow)	810	14					
Agro-Tourism Entertainment	40	1					
TOTAL	5,668	100	415	1,289	1,238	3,569	4,916

Table 6: Projected Production Output 2-acre Farms TTABA Model

Crop/ Livestock	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Lemon Grass (kgs)	270,833	729,167	1,458,333	1,822,917	1,822,917	1,822,917
Eddoes (kgs)	234,375	781,250	1,250,000	2,250,000	2,250,000	2,250,000
Red Beans (kgs)	18,545	24,727	24,727	24,727	24,727	24,727
Noni (kgs)	0	0	0	600,000	900,000	1,350,000
Exotic Citrus (kgs)	0	0	0	0	300,000	600,000
Shadow Beni (kgs)	25,000	60,000	120,000	240,000	240,000	240,000
Ackee (kgs)	0	0	0	200,000	1,000,000	3,000,000
Dairy (Litres)	709,560	709,560	709,560	709,560	709,560	709,560
Golden Apple (kgs)	814,000	3,874,540	6,199,264	8,059,043	12,088,565	16,923,991
Papaya (kgs)	546,000	2,244,667	2,244,667	4,040,400	7,272,720	7,272,720
Coconut (Water-nuts)	0	0	0	0	0	2,850,000
Corn (cobs)	5,454,450	13,475,700	26,951,400	40,427,100	40,427,100	40,427,100
Sweet potato (kgs)	741,000	2,871,375	5,742,750	11,485,500	22,971,000	22,971,000
Goat Milk (Litres)	0	833,571	1,440,000	1,440,000	1,440,000	1,440,000
Plantain (kgs)	537,600	2,903,040	2,903,040	2,903,040	2,903,040	2,903,040
Rabbit Meat (kgs)	75,938	101,250	101,250	101,250	101,250	101,250

CONCLUSION AND RECOMMENDATIONS

Land utilization by 2-acre farm recipients of Caroni (1975) Limited programme has been determined as less than 5%, after five years principally because of inadequate infrastructure and lack of technical and managerial competence to cultivate heavy clay soils of low fertility and other intractable physical constraints. The prospect of accelerated occupation and cultivation is limited because of a combination of recipient frustration, lack of capital and an absence of agricultural interest.

TTABA has a mandate to provide services to facilitate the organized and coordinated planning and development of the agri-business sector. The TTABA model of consolidated agri-business development for strategic commodities (root crops, vegetables and fruit crops) advances a possible sustainable use of strategic Caroni (1975) land resource.

TTABA has an inherent capacity to provide technical and agri-managerial skills in land development and engineering, agronomy, marketing, processing and training. Production efficiency would be enhanced through crop zoning and scheduling, rationalization of machinery and equipment use, production and marketing scheduling and sustainable development of the soil and water resources.

Strategic enterprises including tree crops, root crops, aquaculture, small ruminants and legumes are proposed and are consistent with soil and land capability studies and TTABA development priorities.

Acronyms

ADB	-	Agricultural Development Bank
EMA	-	Environmental Management Authority
EMBD	-	Estate Management and Business Development Company
GOTT	-	Government of Trinidad and Tobago
MALMR	-	Ministry of Agriculture, Land and Marine Resources
NADP	-	National Agri-business Development Programme
NAMDEVCO	-	National Agricultural Marketing and Development Company
TTABA	-	Trinidad and Tobago Agri-business Association

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