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# SOME FACTORS AFFECTING REVITALIZATION AND MODERNIZATION OF AGRICULTURE IN THE CARIBBEAN

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Agriculture is the dominant industry in most of the developing countries of the world. In the developing countries of the Caribbean, approximately 80% of the population are directly/indirectly dependent on agriculture for their livelihood; consequently it influences directly the socio-economic and political aspects of life.

Although a number of technological innovations and improvements in agriculture have taken place during the last two decades, their adoption and practice have been slow in the Caribbean, resulting in no significant improvement in production per unit area. The average yield of some economic crops in the Caribbean compared to the yields in developed countries, would clearly indicate that there is vast scope for improvement of yields of these crops (Table I).

The Food Import Bill of the region is staggering, exceeding US\$1 billion in 1988. Table 2 indicates the food import bill of Jamaica. Considerable amounts of foreign exchange are spent for the importation of corn, seed potato, rice, flour, livestock feed, dairy products, soybean, onion etc., most of which can be grown in the region. However, this can be achieved only with the concerted efforts of farmers, researchers and governments.

In order to optimize overall agricultural and livestock production, an Integrated Farming Systems approach is suggested. Within its framework, revitalization and modernization of agriculture should be carried out. Integrated Farming Systems methodology takes into account all aspects of agricultural production, interdependencies of their by-products and efficient utilization of available resources (Preston 1986). Figure 1 illustrates how the natural resources of solar energy, rainfall, nitrogen, soil and farm management can be considered in an integrated production system.

The Integrated Farming Systems approach

is suitable for the needs of the small farmers of developing countries. Although the system can be modified to suit the particular needs of specific farmers, this can be the basis on which overall improvement of agriculture could take place.

This paper describes some important factors necessary for agricultural revitalization and modernization in the Caribbean and examines their implications for agricultural development.

## FACTORS AFFECTING REVITALIZATION OF AGRICULTURE

The following are some measures and factors which need to be implemented in order to achieve the objective of revitalizing the agriculture.

### (a) Development of New Hybrid Varieties

When existing crop varieties reach their genetic and economic production potential, introduction of new traits into the varieties for added advantage is necessary. Crop breeding programmes incorporating qualities such as enhanced resistance to pest and disease, higher nitrogen fixation, ease of harvest, higher protein content etc. need to be initiated. These traits may also result in higher yields. For example, where cowpea is dependent on symbiotically fixed N<sub>2</sub>, superior N-fixing genotypes are higher yielding (Graham and Scott 1983).

Research has shown that inoculation of rice with *Azospirilla*, wheat with *Azospirillum* and corn with corn root bacteria resulted in increased yields in France and Israel (Garnier and Bigault, 1983; Reynders and Vlassak, 1982).

The time has come now when there is a need to incorporate traits such as disease resistance, high protein etc. in the breeding programme of the region's economic crops.

It is essential to diversify crop production to

include economically important crops. In order to continue and sustain the production of new crops a Caribbean Seed Production System may need to be established. In addition, such a system will enhance self-sufficiency in seed production.

*(b) Use of Marginal Unproductive Lands*

*(i) Livestock production:* The need for self-sufficiency in livestock production in the Caribbean based on available feed resources including pastures cannot be overemphasized. Improved local pasture is a cheaper and better source of feed for the cattle (Keoghan, 1982). Adaptable and productive pasture species for acid and alkaline soils of the Caribbean have been identified (Keoghan, 1980; Ahmed, 1987a,b, 1986). These should serve as a guide for pasture establishment and utilization on marginal, and unproductive lands for livestock production.

Preston (1986) emphasizes resource utilization for developing countries for animal production. This would mean increased utilization of agricultural by-products such as citrus pulp, coffee hull, ammoniated rice straw, fish meal etc. for livestock production system.

Incorporating legume meal of canavalia (3%), Leucaena and Gliricidia (5% each) in the diet has been successfully used in poultry production (Preston, 1987). Similarly, 70% of Leucaena leaf meal fed to pasture grazed animals recorded a liveweight gain of 0.56 kg per day compared to 0.37 kg per feed block (Keoghan, 1982). Garcia (1987) showed that even addition of 20% Leucaena could result in 1.0 kg liveweight gain per day. Utilization of such tree legumes should be a common feature of the livestock production system. These would decrease dependence on imported protein feed, save foreign exchange and make a profitable return on investments.

*(ii) Aquaculture:* Areas where land may be unsuitable and uneconomic for any other form of agriculture, can be used profitably to make ponds to raise fresh water fish. Such fish are high in demand and can earn valuable foreign exchange. Feed rations are available locally in the market. Fish such as *Tilapia mossambica* (African perch), *Tilapia nilotica* (Silver perch), red hybrid tilapia, carp and shrimp can be successfully raised in ponds.

In Jamaica aquaculture is a profitable commercial venture. In 1987, Jamaica exported approximately 27,000 kg fish fillet to North America which met only 50% of the demand (Wint, 1988). In

general, local demand for fish in the Caribbean outstrips the supply. Local fish production ought to be increased to meet local demands first and then the overseas demand. Once a fish variety is imported, the fingerlings are best produced locally, which then can be cultivated/cultured by the farmers.

*(iii) Swampy land:* These types of areas, otherwise unproductive, may be used profitably for two purposes: to raise swamp buffaloes (*Bubalus bubalis*) (NRC, 1981) which will help to substitute for shortage of cow's milk and beef in the Caribbean, and to grow rice (Ganpat et al, 1987) to meet the internal demand.

*(c) Economic Use of Fertilizers and Insecticides*

While usage of fertilizers, herbicides and insecticides/pesticides are important, their economic application need to be practised in the field. Farmers usually apply higher dosages of fertilizers and insecticides since they do not feel secure with the company recommended rates.

Agro-chemical outlets often advise farmers on the usage of various agro-chemicals. However, their advice is aimed at profit making and therefore, farmers benefit little. As such there is a need for a comprehensive evaluation programme of fertilizers and insecticides for various ecosystems.

It is very important to determine the exact nutrient element requirements for specific crops in specific areas. It is equally important to evaluate and determine optimum rates of insecticides for specific crops.

## **FACTORS AFFECTING MODERNIZATION OF AGRICULTURE**

If the production level of some economic crops of developing countries are compared to that of the developed world, there is a vast scope for further increase in the former countries. Even without competing with others, these nations need to develop improved agricultural techniques in the thrust towards agricultural development. This objective can be achieved only through improvements in all areas of agricultural productivity.

*(a) Use of New Techniques*

There is an immediate need to develop new techniques in agriculture suitable to our requirements. Recently, advances have been made in the area of Tissue Culture Technology to produce

virus-tested planting materials. The main objective of this new technology is to make countries self-sufficient in planting materials thus saving and sometimes earning foreign exchange.

Using tissue-culture techniques, Scientific Research Council (SRC) at Jamaica, has micro-propagated several varieties of irish potato, yam, banana, sweet potato, cassava and ornamental plants (SRC, pers. commu.). Tissue-cultured yam has made a positive impact on the yam export of Barbados (Mantell and Haque, 1979; Mantell et al., 1979). The University of the West Indies at St. Augustine and Mona, SRC at Kingston, and CARDI, Barbados are engaged in production of disease-free planting materials of yam, sweet potato, irish potato etc. Their efforts should also include other economic crops and selected ornamentals for which there is a great demand abroad.

#### *(b) Production of Basic Tools for Agriculture*

In the Caribbean, agricultural plots are small, hence the need of small equipment for crop production. Implements commonly required would be for planting, weeding and harvesting. Since these tools are not produced locally, there is a great need to make these here.

However, attempts have been made to construct some equipment. Institutions such as UWI, CARDI and CARIRI have built some implements a list of which appears in Table 3. It is apparent that basic tools can be produced here. These are some efforts in the right direction which have to be intensified, broadened and continued. There is a need to develop proper tools to sow seeds, control weeds, harvest and clean produce.

#### *(c) Biological Control of Insect Pests*

For safer, natural, low-cost and effective control of insect pests, the importance of biological control cannot be overemphasized. In most Caribbean islands, this method has been very effectively employed.

Biological control of sugarcane moth borer (*Diatraea saccharalis*) in Barbados resulted in average of BD\$2.5 million per year reduction in damage and losses (Alam, 1985). The moth borers were also controlled in St. Vincent, St. Kitts, Trinidad and Jamaica (Alam, 1985; des Vignes, 1985; Falloon, 1985), thus, saving a substantial amount of crop and money. A list of other economically important pests which have been controlled successfully in the Caribbean are

presented in Table 4. The table shows that bio-control has played an important part in controlling many important insects of various crops. Ways must be found now to control insects of other economic crops including rice, potato, banana and coffee. In addition, small farmers should have access to biocontrol technology.

#### *(d) Commercialization of Agriculture*

There is a need to practice both intensive and extensive agricultural methods particularly in the island countries. Agricultural activities in other words should be commercial-oriented. There are a number of crops in the region which deserve this attention, e.g. corn, soybean, rice, red bean and irish potato. One of the basic premises to grow these crops successfully would be to offer a guaranteed price to the producers.

Import of most of these commodities incur a huge loss of foreign exchange to the Caribbean countries. Corn and soybean are used as primary ingredients in livestock feed. Jamaica in 1988 spent US\$64 million to import these. The local climatic and soil conditions are conducive to their production. Research has shown that corn, rice, potato, cowpea and soybean can be successfully grown in the region (Indalsingh, 1987; Georges, 1987, Buxo, 1987; McGann, 1985). Local production of the above-mentioned crops will enable the release of foreign exchange which can be used to procure better and more efficient farm machinery and equipment.

#### *(e) Proper Marketing Facilities*

Proper marketing facilities are important for agricultural production and need more attention from relevant authorities. As stated earlier, before a farmer grows a crop, he requires a guaranteed price and a guaranteed market. Access to efficient markets serves as an incentive for farmers to specialize in the production of crops which are comparatively most advantageous for the agro-ecosystem in which they operate (Chase and George, 1985).

Few countries have the system of a Central Marketing Agency and even then the facilities may not be adequate. Policies to improve the efficiency of agricultural marketing systems should be formulated and implemented and modified from time to time according to the circumstances/needs. Farmers also need proper encouragement and information on export markets.

(f) *Transportation Facilities*

Most agricultural lands are located in remote areas/hinterland where road facilities hardly exist in the developing countries. This inaccessibility due to non-existent or bad roads makes it hard on the part of the farmer to bring a crop to the market at the right time.

Proper accessibility from the farm to the market, water and electricity are prerequisite to any successful agricultural production.

The other aspect of crop transportation is the vehicle itself. Very few Caribbean countries give priority and adequate incentives to farmers to buy vehicles (pick up, truck, tractor etc.) for agricultural purposes. Fewer vehicles of these types are even imported for this reason. Farmers should be allowed to bring in duty free pick ups, trucks, tractors, etc. which are used in crop production activities.

(g) *Government Policies for Small Farmers*

This is one of the most important factors if revitalization and modernization of agriculture in the Caribbean is to be considered seriously. Government policies should reflect helping the small farmers who are the backbone of a nation. The small farmers are supposed to be provided with adequate credit facilities when needed and extension of credit facilities if possible.

In addition to subsidies to the farmers, the government should pursue protective tariff policies concerning certain agricultural products in order to protect local agricultural productivity. Government subsidies and tariffs are common practices even in the United States, where advocacy for free market and free trade is strong.

Government policy should also make provision for regularizing land leases and extend the durations, if necessary. This is important to obtain credit from the banks. As most small farmers cannot buy farm machinery, Government should facilitate them by providing equipment on lease or rent on easy terms.

Most significantly, interest rate on the credit for agricultural loan should be determined by the Government, which should be much lower than commercial rate. *Agriculture is not that profitable a venture which could compete with industry.* Commercial interest rate on loans should not be at par with interest rates on agricultural loans.

Government should encourage programmes in the media for farmers' training and solutions of

their problems.

Developing countries should pursue policies favouring the saving and earning of foreign exchange, reducing production costs, maximizing local resources for optimum production and above all, attaining self-sufficiency in food production. Agriculture, only then, can be a viable and productive industry in the developing Caribbean country.

**NOTE:** *Views expressed in this paper are solely the author's and do not necessarily reflect any opinion of the Scientific Research Council.*

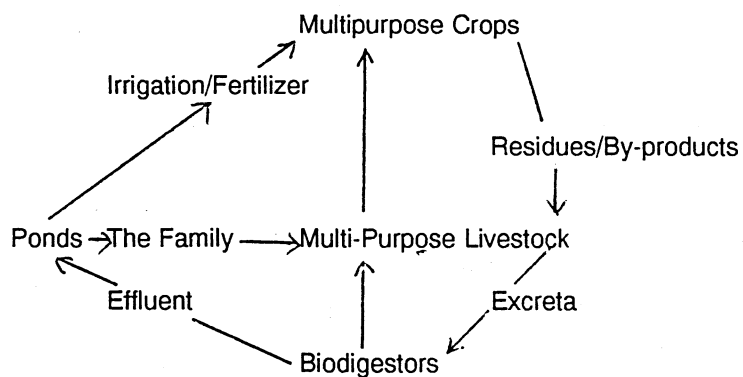
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**FIGURE 1: FLOW DIAGRAM FOR INTEGRATED FARMING SYSTEMS**  
(Preston, 1986)



**TABLE 1. AVERAGE YIELD OF SOME SELECTED ECONOMIC CROPS IN THE CARIBBEAN AND DEVELOPED COUNTRIES**

Selected Crop	Yield (kg/ha)	
	Caribbean	Developed Countries
Rice	2,320	5,667
Corn	1,901	5,002
Sugarcane	44,882	80,175
Potato	7,298	16,281
Cassava	10,671	12,216
Yam	8,220	17,874
Sweet Potato	5,406	17,621
Tomato	8,795	32,104
Groundnut	1,086	2,338
Coffee	558	775

Source: FAO Yearbook (1988).

**TABLE 2: COST OF SOME SELECTED AGRICULTURAL ITEMS IMPORTED INTO JAMAICA, 1985-88**

Year	Value J\$'000			
	Corn	Sweet Potato	Rice	Flour
1984	130,550	-	-	-
1985	135,860	2,191	-	-
1986	78,253	2,430	-	-
1987	87,570	1,354	-	-
1988	120,535	3,902	131,000	1,000

Source: External Trade Statistics, Data Bank and Evaluation Unit, Ministry of Agriculture, 1988.

**TABLE 3: SOME SELECTED AGRICULTURAL MACHINERY CONSTRUCTED IN THE CARIBBEAN**

Machinery	Crop	Purpose	Institution Built	Reference
Three machine system	Cassava	Stake preparation planting lifting	UWI	Harvey (1987)
Mechanical chipping and drying	Cassava	To make cassava chip and dry them	UWI	Sankat et al (1987)
Rice Thresher	Rice	To thresh paddy	CARIRI	Spence & Kathirkamathamby (1987)
Coconut Dehusker	Coconut	Separate husk from coconut shell	CARIRI	Personal communication
Pigeon Pea Huller	Pigeon pea	Separate seed from the pod	CARIRI	"
Corn Sheller	Corn	Separate corn from the cob	CARIRI	"
Fruit Juice Processor	Most fruits	Extract juice	CARIRI	"
Peanut Sheller	Peanut	Separate Peanut from shell	CARDI	"
Cassava chipper	Cassava	Chip cassava tubers	CARDI	"



TABLE 4. BIOLOGICAL CONTROL OF INSECT PESTS IN THE CARIBBEAN

Insect Pests	Crop	Country	Reference
Sugarcane moth borer ( <i>Diatraea saccharalis</i> ) (f)	Sugarcane	Barbados St. Vincent Trinidad Jamaica	Alam (1985) des Vignes (1985) Falloon (1985)
Diamond Back moth ( <i>Plutella xylostella</i> ) (L)	Cabbage Cauliflower	Barbados, Antigua St. Kitts/Nevis	Alam (1985)
Army worm ( <i>Spodoptera pp</i> )	Maize	Barbados	Alam (1985)
Cotton semi-looper ( <i>Pseudoplusia includens</i> )	Tomato Sweet potato Okra, Bean	Barbados	Alam (1978)
Yam scale ( <i>Aspidiella hartii</i> )	Yam	Barbados	Alam (1974)
Citrus blackfly ( <i>Aleurocanthus woglumi</i> )	Citrus	Barbados	Alam (1974)
Onion thrips ( <i>Thrips tabaci</i> )	Onion	Barbados, Eastern Caribbean	Alam (1974)
Coconut mite	Coconut	Jamaica	
Diamond back moth	Crucifers	Jamaica	Alam (personal communications)