

## Developing a Research Agenda for the Caribbean Food System to Respond to Global Climate Changes

### AGROPROCESSING

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#### Introduction:

It has been established by many Scientists that there is global warming due to the depletion of the ozone layer at certain points of the earth's cover, and the accumulation of carbon dioxide gas in the atmosphere. This has resulted in the Green House Effect. Some environmental changes envisaged by the year 2100 due to these two phenomena include:

- Global average surface temperature increasing by  $0.6 \pm 0.2^\circ\text{C}$  over the 20<sup>th</sup> century values, resulting in  $1.4 - 5.8^\circ\text{C}$  increases by 2100 relative to 1990.
- Global average sea level rising by 0.09 – 0.88 m by 2100.
- Changes in climatic variability, frequency and intensity of some extreme climate events

The impact of these changes on the world's food production and availability, earlier discussed by Working Group 1 of the IPCC TAR includes:

- General reduction in crop yields in most tropical (the Caribbean is in this region) and subtropical regions for most of the projected increase in annual average temperature.
- General reduction with some variation in potential crop yields in most regions in mid latitudes for increase in annual average temperature.
- Increased potential crop yields in some regions at mid altitudes for increase in temperature.

Dr. Ulric O'D Trotz reported that:

- Crops:

- In the tropics, yields of some crops near their maximum temperature tolerance are expected to decrease with even minimum changes in temperature. If coupled with large reductions in rainfall, yields will even be more adversely affected.

- Few degrees projected warming will lead to higher crop yields in the temperate regions. However larger increases will lead to a reduction.

- Animals

- Increases in temperatures in extreme events are likely to increase heat-stress related livestock deaths

- Winter warming may reduce neonatal deaths at temperate latitudes.

- Fisheries

- Degradation of mangroves, reefs, sea grass beds, which serve as habitats will have a profound effect on biological production of oceans including fish production.

- Changes in upwelling rates will have a major impact on coastal fish production
- Increase in frequency of El Nino events will lead to decline of plankton biomass and fish larvae abundance, which in turn will adversely affect fish and ocean biodiversity.

Projections of the effects of the predicted climate changes on agricultural products for the world's regions are as follows:

- Africa -Grain yields are projected to decrease thereby diminishing food security
- Asia -Agriculture productivity will decrease, resulting in diminished food security in many countries of arid, tropical and temperate Asia, but agriculture will expand and production will increase in the northern areas.
- Latin America (Caribbean) -Yields of important crops are projected to decrease and there would be a high threat to subsistence farming.
- Europe -Broadly positive effects on agriculture would occur in Northern Europe, but a decrease in productivity in Southern and Eastern Europe.
- Australia/New Zealand -Net impact on some temperate crops may initially be beneficial. However, this balance is expected to become negative for some areas and some crops with further climate change.
- North America -There will be declines in food production due to drought in some areas of Canadian Prairies and the Great Plains of the U.S.A. However, increased food production may occur in areas of Canada, north of current production areas. The benefits of global warming for crops would decline at an increasing rate as temperature increases, and finally become a net loss.

#### The Research Agenda:

To determine the way forward, it is essential to highlight (i) -the raw material requirements of the agroprocessing industries of the Caribbean (ii) –the sources of the raw materials, and (iii) – evaluate the effects of the predicted climatic changes on future availability of the raw materials. Available data (up till '92) <sup>4</sup> indicate that most of the agricultural imports into the Caribbean Region are from North America, Europe, Australia and New Zealand, and consist of temperate crops e.g. wheat, maize, barley, oilseeds/meal, animal products etc. The prediction for most of these crop imports used in agroprocessing is increased yield, with modest increases in temperature, but a decrease in yield as the warming continues. The Agroprocessing industries that would be affected by the predicted changes include:

- Cereal processing Flour mills, bakeries and confectionneries etc.  
Beverage manufacture e.g. malt production and or utilising industries
- Meat, fish and poultry production and processing

- Oil processing / oil feed processing
- Animal feed (meat, poultry, fish etc).

The basic approaches to solving problems in the Food and agroprocessing industries from the expected shortfall of agricultural products due to climate changes are:

- Development of new food types
- Developing substitutes for and adapting of raw materials for use in food and beverage production
- Changing processing methods

For the Cereal flour and associated industries, the U.S.A has for some time now concentrated research on alternate cereals, which are drought and heat resistant. These cereals include sorghum and pearl millet, which are grown in parts of Texas, Oklahoma, Nebraska and Kansas. To support this research, these cereals are being processed into products traditionally obtained from wheat, maize and barley flours e.g. bread, cakes, cookies, tortillas, pop sorghum larger beer etc. Research into the use of these cereals either singly, or combined with other cereals to make a composite for the preparation of traditional foods is being conducted. Additives that possess properties that are lacking in these cereals, (e.g. gluten substitutes, gums, oxidising agents etc., for a good bread loaf) are being evaluated.

The Caribbean is noted for the production of bananas, plantains and root crops. These crops and fruit crops such as breadfruit and breadnut, which are tropical and can survive the envisaged changes in the climate, should be studied for their suitability for conversion into traditional wheat flour food items or into novel foods.

As regards the beer breweries, sorghum has been proven as a good substitute for barley in the production of larger beer, in certain parts of the world. Beer made from maize or sorghum grits, mashed with extrinsic enzymes are not distinguishable from beer made from barley malt.

- Oil mills -The traditional oil seeds, e.g. rapeseed, canola, soybean, used for the extraction of cooking oils also imported from North America and Europe will be affected by global climate change. Agricultural raw materials of tropical origin, that are thermal and saline-durable e.g. coconut, palm oil trees, for the production of palm oil and palm kernel oils, and annuals e.g. sunflower plants, should be developed. Other tropical oilseeds of interest include the okra seed, which contains as much as or more oil than soybean, and the avocado fruit. The avocado seed might also contain enough oil to make it exploitable as an oilseed. Processing and preservation methods to improve the nutritive, preservative, and functional properties of these oils, and the probable use of their meals as animal feed, should form an integral part of future research efforts.
- Beverages -These are divided into alcoholic and non-alcoholic beverages. For the alcoholic beverages, e.g. rum, it is unpredictable how drought might affect the supply of the raw material currently in use. Therefore roots and tubers and bananas and plantains, should be

evaluated as alternative substrate for alcohol production. The malting and production of lager beer from cereals, other than barley, has already been perfected and is in practice. This involves changes in both the process and process machinery. Research in this area should continue.

For the nonalcoholic beverages, the preponderance of fruits in the Caribbean, many of which are underutilised, makes this a fertile area for research, especially for utilisation as raw materials, should present source of supply fail due to global climate changes. For tea-like beverages, several local leaves/herbs that are credited with having good tea properties include avocado leaf, fever brass, lemon grass etc. It is imperative that studies are conducted on these materials vis a vis components and procedures for extraction, production, preservation etc. Research on the properties and preservation and production techniques of ginger, ginger beer, sorrel drink development, should continue.

- Animal products: -Research in meats and meat products should be based on development and salvage. Focus should be on the development of new materials from salvaged meat, poultry and fish products; through the development of meat analogs, meat substitutes, dairy and dairy product substitutes, e.g. turkey or chicken bacon from underutilised parts, fish patties from underutilised fish, cheese from whey, vegi-cheese, meatless bacon, meat loaf.

#### Conclusion:

Research should aim at reducing the dependency of the agroprocessing industry of the future on imported material. Granted that most of the islands have a small landmass, areas that may not sustain the industry's needs, the survival of agroprocessing would depend on how much of the material required by the industry is produced locally, utilising the prevailing climate/resources of the Caribbean.

#### Bibliography:

Global Environmental Change and Food Systems "GECAFS" A joint project of IGBP, IHDP & WCRP in research partnership with the Consultative Group on International Agriculture Research (CGIAR) and in collaboration with WMO. Emerging issues for world food production (Adapted from IFPRI, 1997).

Neville Trotz (2002). Global change impacts on the Caribbean Food System and current and potential environment consequences impacts of increasing food production. GECAFS Caribbean Food System "Issue Identification" Workshop. Trinidad, April 22 – 23, 2002.

US AID 1996. Latin American and the Caribbean Selected Economics and Social data,  
Environmental indicators. Food & Agriculture Organization (AGROSTAT PC).  
<http://lanic.utexas.edu/la/region/aid/aid96/environment/agrindex.html>