caribbean food crops society

Eighteen
Annual Meeting
August 22 to 28th 1982
Dover Convention Centre
BARBADOS

Vol. XVIII
PROCESSING TECHNOLOGY AND FREE FREIGHT TO TEMPERATE CLIMATE COUNTRIES FOR CARIBBEAN FRUITS AND VEGETABLES

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ABSTRACT

By elementary processing, the following transformations are easily made:

i. fruits and nuts to confectionery
ii. juices to syrups and nectars
iii. vegetables to cocktail pickles and pre-mixes

The end-products of these transformations invariably command higher unit prices than their corresponding raw-products. Most are shelf-stable, require simple packaging, and enjoy a high rate of consumption in temperate zone countries, the Caribbean's major source of tourist-dollars.

Flexible film packages are readily available imports, and the massive importation of bottled foodstuffs and beverages has as one consequence unused millions of assorted glassware, much of which could be modified by relatively inexpensive glassblowing and lithographic techniques into suitable, attractive containers. Ministers of trade would therefore be well advised to examine the feasibility of glass-modification factories, instead of the more capital and energy intensive manufactories of glass and tin containers.

Given the proper organization, the region's fruit and vegetable industry might then reap a harvest of hitherto unknown wealth, by imitating the rum and souvenir industries in which the dynamic winter population of tourists is a free freight-carrier of indigenous products to mainland, consuming markets.

INTRODUCTION

With the exception of the banana, citrus and pineapple, Caribbean fruit production is largely disorganized, in the sense that it is the undertaking of a rural society whose members rely on their own initiative to manage no more than a few acres, or who reap wild harvests from the untended contryside. The guava, avocado, tamarind, soursop, papaya, mango, date and many other fruits are less traditional commodities of international commerce which has not generally been exploited. This

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Conference's focus on the economic aspects of fruit and vegetable production implies recognition of the importance of improving employment prospects and incomes in the helter-skelter agricultural sector. Vegetable production suffers similar and related handicaps.

DISCUSSION

The immediate solution to limited prospects for fruits and vegetables is to increase domestic consumption by lengthening the marketing interval of seasonal crops, and creating novel, uniquely Caribbean products and flavors with international appeal.

A significant, non-resident population of Caribbean nationals is domiciled in North America and Europe, and the bi-lateral traffic across the Atlantic Ocean is year-long. Also, the dynamic influx of winter vacationers into the region is yet another component of the consuming populations which numbers more than one million visitors (one-hundred thousand to Antigua alone) entering and leaving the region annually. The rum and ornaments industries have successfully capitalized on this traffic to insure a successful international trade with minimum attendant costs.

Characteristics of tropical fruits and vegetables

Tropical fruits tend to be softer and juicier at processing maturity than many temperate-climate fruits. They usually do not store well (in cold storage), and therefore are harvested close to their optimum processing condition (Tressler and Joslyn, 1971). Sugar content may range from 1.82% (the avocado) to 73% (the date), and acidity may be as high as 23.8% (expressed as tartaric acid in tamarind) (Nagy and Shaw, 1980).

Vegetables tend to be less acidic than fruits, and they suffer a faster rate of deterioration during juice (sap) extraction and processing, without thermal or chemical treatment.

The importance of acidity

The microbiology of processed foods dictates different heat processes for low-acid (pH 4.6 and below) and high-acid (above pH 4.6) foods. Many of the tropical fruit extracts are in the latter category, as a result of their natural acidity. Bacterial spores are unable to germinate at or below pH 4.2 (Pederson, 1979), and mycotoxins are not normally produced in sound fruits, with the possible exception of figs (Stoloff, 1977).
Lengthening the marketing interval

The lethal heat commonly given fruit juices with a pH of 4.6 and below is 190°F - 230°F for 15-2 seconds. Vegetable and fruit juices with a higher pH are spared drastic thermal processes by acidification with edible organic acids and by blending them with more acidic juices, then similarly pasteurizing the blend. Thus, expensive energy is saved, and with good manufacturing practices, the products could be stored indefinitely at room temperature.

Novel Caribbean creations

Tropical fruits can be prepared in different ways as specialty breads and pastries, and as processed goods including purées, nectars, juices, frozen slices or chunks, mixed beverages, powders, baby foods, jams and jellies, concentrates and candied items. Many of these are prepared during or soon after the harvest which in the Caribbean does not always coincide with the peak of the tourist season. For those that do, processing and storage costs are less critical. For those that do not, choices must be made about the most economically feasible method of preservation and storage. The best choices are those that exploit the natural environment in establishing economical processes.

The best choices

Fermentation. Cider is an alcoholic beverage (0.5-8% ethanol) resulting from a natural fermentation of fruit (and vegetable) juices. It is relatively unstable, and must therefore be chemically or thermally treated in order to prolong shelf-life. Heating destroys the natural carbonation. Its manufacture is conducive to small-scale industrialization.

Wine results from controlled fermentation (pure yeast inoculum and an artificially elevated sugar content) of juice to give an ethanol concentration of 14%-18% in the terminal beverage. This level of ethanol makes it a biologically stable product. Its technological and capital requirements are much greater than cider's.

Pickles are delicatessen items of a natural fermentation of fruit and vegetable tissues during which sugar is oxidized further to acid (notably lactic acid). The process depends on the combined action of acid and salt for maximum preservation. The fermented product should be stored under anaerobic conditions.

Canning and refrigeration. These may be expensive, indeed prohibitive technologies where such systems do not already exist. The former relies extensively on "advanced" expertise, because of public health considerations.
Industrialization based on these two systems will require elaborate instrumentation and machinery that are exogenous to the region.

Dehydration. This process should perhaps be the most logical choice in the Caribbean climate (high temperatures, low humidity and vigorous air currents). A natural lowering of the water activity of fruit tissue, combined with nominal thermal and/or chemical pretreatment, is an established method of preserving dates, tamarinds, etc., in tropical production areas. Numerous other fruits are amenable to controlled drying (dehydration). The technology needs to be extended regionally, with though awaiting a North American or European precedent.

Candying and jellying. Candy and jelly manufacturers rely on the popular appeal of sugar and fruit flavours for universal acceptance of their products. Caribbean confection is a historical, consumer-level technology on a resource base of more than 600 edible fruits with unexplored market potential (Nagy and Shaw, 1980). Added to this resource base are milk, nuts, eggs, molasses and cane-juice. Simple scientific principles underly this technology which could easily be industrialized concomitantly with improved methodologies and standards.

Organizational necessity

To varying degrees throughout the region, the urgency for new (i.e., non-political) organizations is nowhere more manifest than in agricultural production, specifically in the post-harvest interim before consumption. Commodity interest-groups, focusing purely on aspects of pomology and horticulture, in their own interest, will be the counter-balance to an arbitrary, ministerial bureaucracy. A purely trade (vis-a-vis trades union) orientation of the total production apparatus will facilitate standards for buying, processing, storage, advertising and merchandising of primary and secondary commodities.

Packaging and merchandising

The common denominator of all food processing is packaging. The nature of the finished product determines the kind of package and packaging material used. Not only should they be functional and portable, but in accordance with the theme of this paper, they should have the sensorial qualities to attract and arouse the public's curiosity. New incentives to savour the merchandise should include free samples, and instructions and recipes on the label. Plastic films and economical aluminum containers are readily available, and with modest ingenuity, the myriad of imported bottles and cartons littering the region could be appropriately filled with Caribbean delights and returned to their origins.
by the vacationing population, relatively cost-free, as in a common practice in the rum and ornaments industries.

REFERENCES


