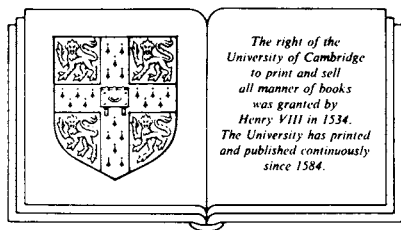


An introduction to tropical food science

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The tropics: an introduction

Geography and climate

The tropics lie between the Tropic of Cancer and the Tropic of Capricorn ($23\frac{1}{2}^{\circ}\text{N}$ to $23\frac{1}{2}^{\circ}\text{S}$) but are often extended to include areas as far as 30°N to 30°S where tropical conditions are found. This area which girdles the globe is large and includes Central America, the West Indies and parts of Mexico and South America. Most of Africa lies in the tropics as do much of the Indian Subcontinent, South East Asia and parts of Australia.

The tropical belt is divided into the dry tropics and the wet tropics. The former include the great deserts of North and Southern Africa, Asia and Australia. One often imagines deserts to consist of an enormous expanse of rolling sand dunes but this is not always so. The only characteristic all deserts have in common is that there is very little water during most of the year and indeed it may not rain for several years. Deserts can consist of high mountain ranges with sharp and rocky contours, rolling hills, dried up river beds and, as expected, rippling sand dunes. There are few plants or plant remains (humus) in the soil and when it does rain the water runs off and dry river beds can become raging torrents in little time. It is an odd sight when travelling through the Mohave Desert in the United States in searing heat to come upon signs saying 'Caution Floodwater'. Even at the margin of the deserts plant life is very sparse. One finds eucalyptus and cactus. Of the food plants mainly three are of significance, the date palm, millet and grain sorghum.

From the food scientist's point of view the wet tropics are far more interesting. A typical example is Southern Nigeria, a hot tropical area with high rainfall in the wet season. Among the cereals, maize and rice are found and among the stem and root tubers, yam, cocoyam and cassava. Fruits are very prolific and one finds mango, pawpaw, breadfruit, coconut, pineapple, peppers, plantain and banana. The main

source of oil is the oil palm. Sugar cane is common and in the rubber plantations, particularly in adjacent Ghana, cocoa is found growing in the shade of the rubber plants. A little coffee is also grown.

Climate does not depend only on the distance from the Equator but also on altitude and distance from the sea. Winnipeg in Canada and London in England are much the same distance from the Equator but while London is close to the sea, Winnipeg lies in the centre of a large land mass. In London the climate is never extreme, temperatures rarely exceeding -10 to $+30^{\circ}\text{C}$. In Winnipeg winters are exceedingly cold, cars leave long condensation trails and if one stands at a bus stop for a few minutes one might feel a tap on one's shoulder and be told 'Excuse me, but your nose is bleeding'. One's nose will then have a white tip and be frozen solid. Winter temperatures of -40°C are not uncommon, but during the summer temperatures rise very sharply to well over $+40^{\circ}\text{C}$.

The effect of altitude is best shown on Mount Kilimanjaro, the 'White Mountain' of Tanzania. The top at 5000 m is barren and covered with snow and ice glaciers. The zone below, still above the snow line, also grows no plants. There is too little water and oxygen. At 3000 m one finds a typical Alpine desert with mosses, lichens and some grass. Every night there is freezing fog and in boggy moorland areas mosses, grass and sedges are found. Below, at 2500 m the climate is no longer extreme. There are giant heathers 12 m high in a girdle of evergreen trees and tree-like ferns. At 2000 m the climate is that of a hot and humid rain forest. Here live the Chagga people. They find firewood on the upper slopes and collect fodder for their milk cows which they keep in sheds. Potato, maize and bananas are grown as well as beans, cabbages and coffee. At the bottom of the 'White Mountain' in the Savannah live the Masai people. These are herdsmen tending their small cattle, goats and donkeys in the typical meadowland of tropical Tanzania.

It is not just temperature however which governs the climate but also the rainfall. In Nigeria the tropical rain-belt of the south of the country gives way in the north to the rainless desert of the Sahara. From a tropical rain forest one passes to a treeless waste. In the monsoon regions, for instance, in India, the contrast is in the same place. In the dry season there is hard dessicated soil and in the wet season mud and water; as if by magic a desert can turn into a fertile garden. Figure 1.1 shows the tropical zone.

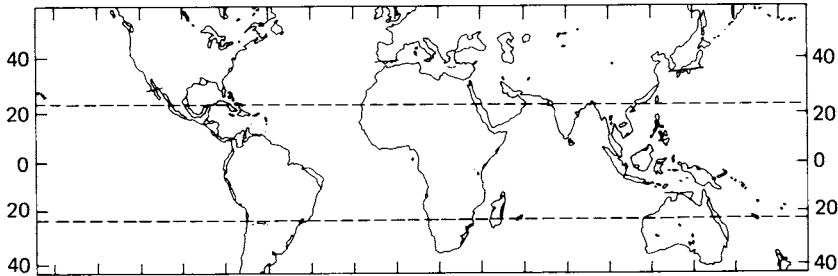


Fig. 1.1. A part map of the world showing the tropical belt.

The effect of climate on food

Storage losses of food in the tropics can be very high. When the weather is hot and dry there is increased wilting of fruits and vegetables. Temperatures in storage bins can reach 50°C. This causes increased respiration of the vegetables with associated weight loss. The heat may also cause increased risk of odour pickup from petrol, paint or tar. This is particularly noticeable with oil or fat-containing foods such as fat meat or groundnuts.

When it is hot and wet, meat, fruit and vegetables may rot very quickly. When relative humidity and temperature are very high, grain and legumes may absorb water from the atmosphere during the relative cool of the night, giving rise to microbial deterioration and ultimately to spontaneous ignition. Drying without special machinery becomes very difficult.

Considerable storage losses can be caused by bacteria, fungi and nematodes as well as insects, birds, rodents and monkeys. Poor road conditions may cause damage to fruit and vegetables by bruising which subsequently leads to rotting. There may be considerable cross infection through domestic waste which may be found in large settlements in huge quantities (Fig. 1.5).

Industrial development in the tropics

There is probably a greater range of industrial development in the tropics than anywhere else in the world. To give an example: one can find the most advanced biscuit plant with a computer-controlled band oven as fine as anywhere in the world. There may also be a brick-built tunnel oven fitted with chain conveyors and baking trays similar to the ovens built in the 1930s in Europe. Then one might see a clay oven in which biscuits are



Fig. 1.2. A market scene in Ibadan (Nigeria).

baked at a very low rate of production and under the most unhygienic conditions. A similar range can be found with other food technologies, sales outlets and indeed cities.

One may find a crowded market with an amazing selection of food and little regard for hygiene (Fig. 1.2). The same town may boast modern supermarkets as good as can be found in many western countries (Fig. 1.3). Similarly one can enter a very poor but clean and well kept village (Fig. 1.4), a shanty town (Fig. 1.5) or a modern metropolis such as Singapore or Hong Kong (Fig. 1.6).

Food supply

In the 1960s to 70s the first comprehensive economic appraisal of food in the world was made and one now recognises three areas. The first includes those countries which are either self-sufficient or food-exporting and these present no food problems. Among the developed countries these include the United States of America, Canada and China and among the developing countries, Thailand, Nigeria and Argentina. The second group comprises those countries which require the importation of food but where foreign exchange is readily available through exports. Such countries are for instance the United Kingdom, West Germany and Japan, and, again, there are no food problems. The third group consists



Fig. 1.3. A shopper in a Nigerian supermarket. (Courtesy Unilever plc.)

of those which cannot grow sufficient food and have too little foreign exchange to buy it in sufficient quantity. These are the problem countries.

Usually they are agricultural with a low standard of technology. They tend to be tropical and often have poor soil and climate. They may be subject to natural calamities like drought and plagues of locusts. They are small in size. Although their populations are small (usually below five million) they are increasing rapidly. They have few technological or scientific resources and about half of them have only obtained independence since 1945. Since colonial powers were interested in cash crops, they tended to neglect the food bases of these areas.

In most countries of the world food production has increased in recent decades. However in many developing countries the population increase, largely due to improved medical care, has been so rapid that the production per head has remained steady or has even decreased (Fig.



Fig. 1.4. A typical village in Northern Nigeria



Fig. 1.5. Such slum dwellings with open drains and huge piles of garbage are typical of many towns in developing countries.



Fig. 1.6. Hong Kong Island. An example of a highly developed tropical city. (Courtesy R. E. Muller.)

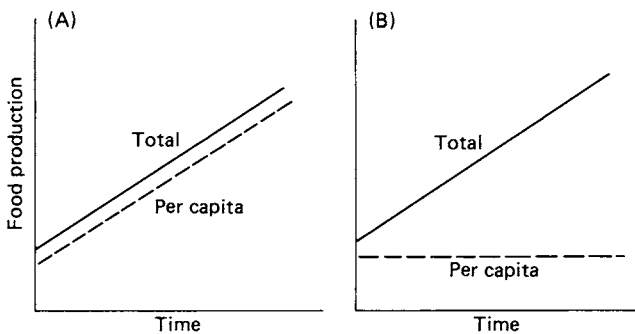


Fig. 1.7. In both (A) and (B) food production has increased equally. In (A) with constant population the per capita food supply has also increased. In (B) due to population increase the per capita food supply has remained steady.

1.7). Acute famines in these problem countries can be relieved by food aid from the developed world but chronic food problems are far more difficult to cure. The problems are various.

Many of these countries have huge debts which must be serviced. Often much of the money borrowed by the developing country promptly flows out again into private accounts in Western banks. Scientific and

administrative organisation is often poor. Local senior administrators may be 'well connected' but incompetent. There may be a severe shortage of local trained personnel particularly at intermediate levels. Lack of education and social responsibility may result in apathy and corruption. Particularly in Africa, that sad continent, regional, tribal and religious rivalries hinder progress.

When a country's leaders meet they rarely discuss food problems unless these have given rise to civil unrest. Sometimes there may be a considerable difference in living standards between towns and countryside and the country's elite may aim to achieve western standards and ignore the agricultural basis upon which ultimately the fate of the entire country depends. Instead of growing food for home consumption, resources may be devoted to the cultivation of export crops to finance often unnecessary western imports.

As a rule these export crops fetch less and less money in the international market, while the cost of western manufactured goods increases steadily. This has been called a subsidy paid by the developing countries to the industrialised world. The moneys given in aid are easily swallowed up by the loss in earnings.

International agencies often provide assistance and advisers. Both may occasionally be useless. Frequently at the end of the adviser's contract there is no follow-up although sometimes valuable personal contacts are made. Finally international agencies may not cooperate with each other, to the loss of all concerned.

However, the picture is not entirely bleak. Much food and agricultural research is financed by international agencies in Africa, Asia and Latin America. Considerable efforts are also made on their own by the governments of Brazil, Pakistan and the Philippines. The spread of communications (radio and television) has helped to increase food production and remote sensing satellites have assisted in drought monitoring by assessing the availability of water through the measurement of plant density indicators. Similarly water resource measurement and crop production forecasts can be made using satellites. International financial institutions such as the International Monetary Fund, the Asian and African Development Banks play an ever greater role in the improvement of many poor tropical countries. Last, but by no means least, intermediate technology has been specially tailored for developing countries and some of its aspects are considered in this book.