2010 Vol. 1 ISSN 1985-7802

Seeds of Trade - Crops That Transformed Humanity

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History is full of the exploits of men and women – their actions are identified as causing change, development and catastrophe. If it pleases people to read and to be told that these things happened as the direct and absolute interventions of human, then this is no surprise – for humans have always liked to believe in their own influence and directions in the course of history. These claims, however, sometimes conceal the truth. The vital and largely unrecognized factor that changed the course of history from time to time is not the human beings, but seeds – the tiny, powerful living entities.

Historical Facts

What led Europeans to spread all over the globe in post-Renaissance times? It has nothing to do with religion or the rise of capitalism – but it had a great deal to do with seeds: the pepper. In the middle age pepper was essential to flavor otherwise insipid vegetables and to mask the taste of rotten meat and stinking fish. By the beginning of the sixteenth century Venice had become rich, famous and beautiful from the profits of the pepper trade. This prompted the great Portuguese, Italian and Spanish explorers to reach the Orient in search of pepper and the Americas were discovered as a by-product of this search. Likewise, the tiny seeds of quinine, sugar cane, tea, cotton, potato and tobacco have played a dynamic role in the socio-economic transformation of humanity.

Quinine cured one of the great banes of existence in Europe, Asia and West Africa: malaria. It enabled the white man to open up the tropics and develop great empires. White settlements became possible – only because of quinine – in areas which hitherto had been defended more ably by disease than by any human agency. Quinine facilitated the transfer of vast numbers of people across the continents as cheap labour. Without quinine they would have died in their new home. The catastrophe of two world wars can be attributed to the seeds of quinine, without which the nations would probably have been unable to fight either of the two wars.

Sugarcane seeds (cuttings) taken by the white man to the West Indies at the time of the Renaissance and cultivated on plantations by black slaves, the only people who could work in the climate, was the cause of the infamous slave trade. All this was for the sake of a product which is wholly superfluous in the diet, a luxury when expensive and a menace when cheap. It led to diverse of human miseries since, after the acknowledged drugs; sugar is probably the most damaging of the commonly consumed addictive substances.

Seeds of tea followed the pepper as the major Eastern trade; by 1700 it had become one of the great non-alcoholic drinks and ruled the drawing-rooms for 250 years. Spread of tea seeds accelerated the decline of China, a country whose civilization was highly sophisticated when Europe was inhabited by barbarians, and the Americas were many centuries away from discovery. The exchange of opium for tea over more than a century was a crime which no-one, even today, acknowledges as the man-made catastrophe that it was.

Tea was more than an incident in the American War of Independence. It was instrumental in the development of porcelain in Europe and China, permanently influenced sailing ship design, and by transfer in the nineteenth century, developed 'garden' in India and Sri Lanka which changed the history of the sub-continent.

Cotton seed taken to the uplands of southern states of the USA resulted in the explosion of American cotton trade, which grew in its lifetime from one bale to 4

million, and included the whole history of Southern slavery and the American Civil War. On the way, cotton seed played a major part from a pre-steam age in England, to dark satanic mills and back slavery, from sail and water power to steam and iron, from cottage industry to industrial technology, from the potential of free black minority, to an enormously increased and recessive slave population.

The potato seed and its culture is difficult to trace but it is believed that potato came from the high Andes, 8,000 feet above the normal crop line, and was a staple starchy food of the Incas. The Incas were a small tribe settled around Lake Titicaca, the world's highest lake. The attraction of their economy for Spanish conquerors was gold and silver, but the Inca's real gift to this world was the seeds of the potato. Almost everyone connects the potato with Irish history, in particular the great famine of 1845-46.

But there are other questions that are not always asked: "Why was Ireland, alone of all western European countries, particularly suited to the potato? Or was it? Why did the Irish adopt the potato at all? Why did the population arise as steeply as it did, creating ideal conditions for famine? Why did the British espouse free trade as an apparent answer to Ireland's problem? Why, after mass emigration, did particular areas of the USA become Irish? – Which might be called the 'greening' of America?

Did the British have any idea of what the Irish tragedy and free trade did to them? "The consequences of the potato seed are still being experienced today in the turbulent inter-relationships between Britain, Ireland and the USA.

Other seeds such as tobacco have played their part in history. Tobacco chewing, for instance, an addiction which swept into fashion in some countries, was the essential import which corrected the chronic balance of payments deficit of the American colonies in 1774. Did it therefore finance the revolution? It is an attractive theory. It is therefore apparent that in pre-and post-Renaissance times the seeds of pepper, quinine, sugarcane, tea, cotton, potato and tobacco have played the most important roles in human history and, as a result, have most influenced the world in which we live today.

In our own time, we have witnessed the transfer of seeds from continent to continent and among the countries of various continents, and this have helped to provide staple food for perhaps 100 million people across the world.

Seven grains have played a critical role in human history, as well as in the modern era of high technology. They are millet, oats, barley, wheat, rye, rice and corn. For thousands of years these grains have provided a basic food supply, with their cultivation laying the foundation for the development of civilization. Of the seven, the most important have been wheat, rice and corn.

Wheat is a cereal and its origin has been traced to the Middle East region, particularly to the valley of the Tigris and Euphrates, an area then called Mesopotamia, now part of Iraq. Mention of wheat is made by the Assyrians and Babylonians in stone ruins dating from 3,000 BC. Records indicate that Chinese cultivated wheat in 2,700 BC and had developed elaborate rituals to honour it. Today, wheat covers relatively larger area than any other cereal crops and is the staple grain food of big population.

Rice is also a cereal like wheat, but with a much higher temperature requirement. A native of India, rice spread eastwards to China, southwards to East Indies and westwards to Persia. The Arabs brought it to the Mediterranean in the seventh century AD. Today rice is a major trade commodity around the world.

Seeds of corn draw its roots from the tribes of the Incas, and various stories are told about how it was transferred to Europe and North America. In modern times, the transfer of corn seeds from America to Africa has provided a staple food for millions of people.

In addition to these cereal grains, a number of other crop seeds have played a dynamic role in the health and nutrition of the modern day world. This class of crop seeds is often referred to as 'grain legumes' or simply 'pulses'. Grain legumes are known to have been cultivated at least since Neolithic times. Phaseolus bean (dry bean) carbon dated to before 4,000 BC, have been found in Mexican caves, and peas of similar age were discovered in Neolithic excavations in Switzerland, in predynastic Egyptian tombs, and in ruins around Troy. Chickpeas seem to have originated in the fertile crescent of the Mediterranean, though some ethno-botanists report early finds in the Himalayas.

The most widely cultivated legumes are the two principal oilseeds: soybean and groundnut that represent roughly 50% and 16%, respectively of the total world production of grain legumes. Among the edible legumes, Phaseolus beans account for over 35% of total world production. In recent times, major transfer of legume seeds across the continents have occurred and are playing a major role in the agronomic, as well as the socio-economic transformation of countries and their people.

Current Trends

It is obvious that in the pre- and post- Renaissance era, the great explorers sailed the seas in search of new seeds and new needs and new crops. Today, the traders of seeds fly the skies in search of new markets, new opportunities, and new applications which are vital to the sustainability of the agricultural industry and the socio-economic development of the people. The changing patterns in the consumption of seed grains during the past two decades represent a major revolution in seeds of trade. This has put enormous pressure on seed scientists, breeders, chemists, growers, processors, and the industry at large, to ensure the production of seeds with precisely the qualities that are required for successful trading.

Seed quality is generally defined in terms of simple physical criteria such as test weight, moisture content and the percentage of foreign material. However, in most cereal seeds, in particular wheat, it is a more complex subject. The four basic criteria used to evaluate

wheat quality are: protein content, grain hardness, dough properties and milling quality. Protein content has a greater influence on overall processing quality than any other single factor. The other three quality factors are related to wheat seeds which exert marked influences on the product quality and consumer acceptance.

The aspects of legume quality are different from those of cereals. When the grain legumes were first domesticated by man, the main considerations were adaptability to particular regions of the world, reliability of yield, taste acceptability and whether the seeds could be transported and stored easily. However, as a result of pressure in recent times from consumer groups and marketing bodies, some guidelines have emerged to specify quality characteristics of food legumes. The quality characteristics of food legumes therefore relate mainly to the acceptability characteristics. As regard to the acceptability characteristics, the main aspects of quality to be considered in food legumes are:

- Acceptability in terms of food, e.g. appearance, cooking quality and sensory factors such as taste, texture and flavor.
- Acceptability in relation to primary processing, e.g. dehusking and splitting.
- Nutritional acceptance of both processed and unprocessed seeds, e.g. seed hardening, and anti-nutritional substances.

The presence of anti-nutrients in most legumes is the most critical factor that may limit the acceptability of legume seeds and its products. These anti-nutrients inhibit the digestibility and utilization of nutrients by interfering with the normal metabolic processes. Management of anti-nutrients requires development of appropriate technology to minimize health risks.

Future Direction

The turmoil experienced in the seed trade is sometimes the direct result of government attitudes, political environments and trade policy. Almost no nation really believes in wholesale free trade throughout the world. Everyone wants to buy in the cheapest market and sell in the dearest. If only one world existed, the concept of free trade would inevitably be true and great. But if the seed grains can be processed cheaply in India because of low labour costs, or motor cars in Japan because of the culture of the Japanese to mass produce goods, or ships in Korea because Koreans enjoy the capital investment of the Americans, then who is to believe in free trade? In the long run, free trade benefits everyone and in the short run it is bound to produce much pain. Furthermore, free trade benefits the strong, the competent, and the people who use new technology.

Technology, therefore, has always played, and will continue to play, a major role in the successful production and utilization of seeds and seed crops. For example, discovery of quinine seeds and plants set off new technology for synthetics which today has diversified into a vast range of industries. Sugarcane triggered the new technology to produce refined sugar and sugar related food products. Revolutions in cotton technology between 1770 and 1790 established most of the features of the modern cotton industry.

Considerable advances have been made as far as cereal seed technology is concerned, in terms of processing and food product development, as well as in industrial application. Relatively little progress has been made as far as grain legumes are concerned and long term focus requires utilizing of the known technology to identify new product uses for grain legumes within the wide range of end product streams and, more specifically, those products which can achieve the highest value added return. Other forms of technologies that are closely associated with seeds include: process technology, biotechnology, plant breeding/gene technology. Application of these technologies is vital for successful cultivation and utilization of grain legumes, whether it is for humans or animal species.

Process technology is often applied to reduce/eliminate the undesirable dietary components of the seeds, or production of high protein concentrates or isolation of starches for industrial applications, and often, as in the case of grain legumes, to further process (dehusking and splitting) the seeds for food and industrial applications. The processes generally applied include the application of mechanical techniques, such as dehulling and air classification, and various forms of heat and chemical treatments. A successful application of process technology requires a sound knowledge of the type, distribution, chemical reactivity and thermal sensitivity of the chemical constituent within the seed matrix. Biotechnology offers techniques for the elimination of undesirable dietary components of the seeds using enzymes of microbial or plant origin. It also offers opportunities for further improving the nutritional quality and food application of seed ingredients. The advantage of a biotechnological approach over the traditional process is a potential for savings on processing costs, significant improvements in nutrient digestibility due to minimal process damage of the raw material amino acids, and a more consistent product. However, successful application of biotechnological techniques is dependent upon a clear and thorough understanding of the chemical constituent under study, enzymes required and reaction conditions.

A successful application of plant breeding techniques requires the availability of rapid screening techniques, adequate genetic variations and the knowledge of environmental effects. In contrast to process technology and biotechnology to improve the dietary benefits of seed constituents, which may be accomplished in a relatively short span of time, the improvement of seed quality through plant breeding must be considered a long term objective. This approach has been successfully applied to improve the quality of peas, faba beans, lupins and dry beans. Virtually unexplored is the possible application of genetic engineering as a means of improving the quality of legumes and cereals. Gene transfer in seeds, particularly in legumes, has in general proved difficult, but the application of either ribozyme technology or anti-sense genes to prevent the expression of functional genes, have the potential.Seeds trade, therefore, will be more technologically oriented as we cruise through the new millennium.