New World Foods and Old World Demography

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The fact that Old world diseases devastated the aboriginal peoples of America and the fact that venereal syphilis in Europe, Asia, and Africa has killed millions and crippled the reproductive capacities of legions seem relatively unimportant when placed alongside the statistics on population growth of the post-Columbian era. It is this latter phenomenon, and not the other two, which is the most impressive single biological development of this millennium. In the last three hundred years the number of human beings on this planet has quadrupled, doubling between 1650 and 1850 and then once again in the last century. The best current quantitative estimation of the world's population history for the past three centuries is listed in Table 1.

It is provocative to those engaged in an examination of the biological consequences of the voyages of Columbus and his generation to note that this population growth has occurred since 1492. Rapid worldwide human population growth probably occurred only twice before in all history: once when man, or protoman, first developed tools and again when man invented agriculture. And then it happened again, after the century in which Europeans made highways of the oceans. Is there a connection between Christopher Columbus and the population explosion?[2]

TABLE 1
WORLD POPULATION (in millions)[1]

	1650	1750	1800	1850	1900	1950
Africa	100	95	90	95	120	198
Asia (excluding USSR)	327	475	597	741	915	1,320
Latin America	12	11	19	33	63	162
North America	1	1	6	26	81	168
Europe and USSR	103	144	192	274	423	593
Oceania	2	2	2	2	6	13
Total	545	728	906	1,171	1,608	2,454

The answer for the New World is probably yes. The number of humans in the Americas has probably increased since the fifteenth century. It seems that for every Indian who died, a European or an African has disembarked and proceeded to found a family. The transfer of Old World plants and, especially, Old World animals vastly enhanced America's capacity to feed this growing population of alien humans.

But how is it that the Old World was able to supply so many millions of emigrants to the New? She did so not by depopulating her own lands: in fact, in the case of Europe, her population was growing so rapidly that the people she sent to America can, by and large, be defined as surplus population. One of the more important factors in the imigration of so many people from the Old to the New World was the population pressure existing in the former. This enables us to focus our question more sharply: is there a connection between Columbus and the population explosion in the Old World?

The causes of the increase are usually given as follows: a decrease in the number and severity of wars; advances in medical science and hygiene; the establishment of stable governments over large areas; improvement in transportation, which permits rapid transfer of food from areas of surplus to areas of famine; and an increase and improvement of food supply. There are others which have also been suggested, but the above are the most widely circulated. How valid are they? Birth and death rates are the result of such myriad factors that demographers agree that all of the given reasons for population expansion are, if taken one by one, invalid. Some, however, have less general validity than others, whatever their significance may be in specific cases. It seems likely that wars, by and large, have increased, rather than decreased, in their destructiveness in the last three hundred years. It is certain that few of the mothers and babies since 1650 have enjoyed the benefits of hygienic surroundings or decent medical treatment. Stable governments probably do enhance population increase, but what about China's rapid population growth in the nineteenth and twentieth centuries, a period on which chaos became increasingly the rule rather than the exception within that empire? Improved transportation certainly helps to limit the number and duration of famines, but it is hard to believe that this is a factor of major importance; and it is certainly true that world population growth began to accelerate generations before the engine—steam, gasoline, or other fuel—replaced human and animal muscle in transportation.

The one factor that will promote population growth and that has been nearly universally influential over the past three hundred years is the increase and improvement of the food

supply. We have come full circle, all the way back to Thomas Malthus. Of course, his theory that population increase follows upon increase in food supply is a grossly oversimplified explanation of an extremely complicated matter, but he was basically right about that phenomenon in preindustrial societies, a category which included the entire human race of his time a century and a half ago. In such societies starvation and malnutrition are usually significant checks on the population growth: therefore, an increase in the food supply will produce an increase of people.

For example, in eighteenth-century Sweden, the nation for which we have the most reliable vital statistics prior to 1800, "Not only marriage but crude birth rates and married and unmarried fertility rates rose following adequate harvest and declined in years following harvest failures; whereas death rates showed an equally strong tendency to rise after a failure and decline in periods of abundance."[3]

The most obvious way in which a people can improve food production is by raising more of its standard crops. But this is not always easy; often most of the land suitable for the traditional crops is already planted with them, and often an increase in the sowing of traditional crops will only bring on an increase in the pests and diseases that prey on them.

An entirely new food plant or set of food plants will permit the utilization of soils and seasons which have previously gone to waste, thus causing a real jump in food production and, therefore, in population. But before we accept this statement as gospel, let us acknowledge that we are taking much for granted. How can we be *sure* that a population which simultaneously switches from wheat to maize and increases in size could not have accomplished the increase without every having heard of maize? Perhaps the switch to maize came not because of its greater productivity but because the people in question simply liked the way it tasted. Perhaps the increase in population stemmed from a dozen or a hundred factors having nothing whatever to do with maize.

But let us proceed. Hypotheses about past events are not susceptible to scientific proofs, and the historian can never hope to have a hypothesis certified as anything better than reasonable. He must lope along where scientists fear to tread. It seems reasonable to say that human beings, in matters of diet, especially of the staples of diet, are very conservative, and will not change unless forced. No coercion is as generally effective as hunger. And when hunger is assuaged—even by the products of alien seed—babies are conceived, are born, thrive, and live to have their laps full of grandchildren.

All the basic food plants are the products of careful cultivation and breeding practiced by the neolithic farmer. Although he never saw or heard of genes, he produced wheat, barley, rice, maize, potatoes, manioc, and other foods—the chief supports of human life on this planet—from wild species so unpromising that only the professional botanist can see the resemblance between today's plant and its ancestor.

We do not know whether agriculture was invented several times in different places in the Old and New Worlds, or only once, and that in the Old World. We do know that the Atlantic and Pacific oceans acted as excellent insulators before the sixteenth century, tending to restrict

cultivated plants, if not necessarily agricultural techniques, to the continents of their origins. Because of the oceans, two different patterns of agriculture grew up in the eastern and western hemispheres. Unfortunately for those addicted to precision, research over the past few decades has made it increasingly obvious that these two worlds were not hermetically sealed, and that prehistoric men did find ways across the great waters for themselves and at least a few or their cultigens. The sweet potato, for instance, a plant of American origin, was cultivated in New Zealand long before the arrival of the Europeans. The old thesis that only the Vikings got from one hemisphere to the other and back before 1492, and that neither they or anyone else carried anything of importance in either direction, is crumbling. But the claim that there were *almost* entirely different groups of food plants cultivated in the Old and New Worlds in pre-Columbian times is still acceptable to historians, archeologists and paleo-botanists. There is no doubt whatsoever that no crop of one hemisphere was a significant source of food for large numbers of people of the other hemisphere before 1492.[4]

The great Russian botanist Nikolai Ivanovich Vavilov, in the course of his research on the geographical origins of various cultigens, made up a list of the 640 most important plants cultivated by man. Roughly speaking, five hundred of them belonged to the Old World and one hundred to the New.[5] Driven by the fact that America provided so few domesticated animals for food, the Indian produced some of the most important of all food plants. He also gave humanity such nonfoods as tobacco, rubber, and certain cottons, but let us restrict ourselves to a list of his most valuable food crops.[6]

Maize	Pumpkin
Beans of many kinds (*Phaseolus vulgaris* and others)	Papaya
	Guava
Peanuts	Avocado
Potato	Pineapple
Sweet potato	Tomato
Manioc (also called cassava and tapioca)	Chile pepper (*Capsicum annuum* and others)
Squashes	Cocoa

The botanists' assurance that these foods are of American origin is supported by the testimony of the etymologists: all but three of the listed names are derived from American Indian words. Collectively these plants made the most valuable single addition to the food-producing plants of the Old World since the beginnings of agriculture.[7]

Of these crops, maize, potatoes, sweet potatoes, beans, and manioc have been most abundantly cultivated and eaten in the last four hundred years. The others have had great significance in restricted areas, but have never become staple foods for as large a part of the human race as the five above.

If maize were the only gift the American Indian ever presented to the world, he would

deserve undying gratitude, for it has become one of the most important of all foods for men and their livestock. Ears of ancient wild maize, recently unearthed in Mexico, enable us to measure the achievement of the American Indian agriculturalist. The mature ear of wild maize was about as thick as a pencil and an inch long. The food value of the whole ear was probably less than a single kernel of twentieth-century maize.[8]

Many types of maize existed when the European arrived in America and many more exist today. As a result, maize will produce good crops in an extreme variety of climates. Its advantage over equivalent Old World plants is that it will prosper in areas too dry for rice and too wet for wheat. Geographically, it has fitted neatly between the two. Its supremely valuable characteristic is its high yield per unit of land which, on world average, is roughly double that of wheat. For those to whom famine is a reality, maize has the additional benefit of producing food fast. Few other plants produce so much carbohydrate, sugar, and fat in as short a growing season.[9]

Despite the fact that the potato does not grow well in the tropics, it is one of the crops raised in greatest quantity by man. Only wheat competes with it as the most important plant food of the temperate zones, and the potato produces several times as much food per unit of land as wheat or any other grain. Furthermore, it can be, and so often has been, cultivated very successfully in tiny plots of poor land in a great variety of temperate zone climates, at altitudes from sea level to well over 10,000 feet, and by the most inept farmers using the most primitive tools.[10]

Although there are few parts of the world where the sweet potato is the primary crop, its unusually high yield—three to four times that of rice, for instance—and its resistance to drought and tolerance of poor soils make it a vitally important secondary crop throughout a wide band of the warmer lands. A good example is to be found in Indonesia, which produced 13.4 million metric tons of rice in 1962–1963—and also over three million metric tons of sweet potatoes.[11]

The bean was one-third of the alimentary trinity that supported Meso-American civilization when the Spaniard arrived—the other two members being maize and squash—and plays a role of similar, if not equal, importance in the diets of millions throughout the world today. The bean family contains over one thousand species—some New, some Old World in origin—and since most writers and statisticians have been satisfied that “beans is beans,” it is difficult to make precise statements of the importance of *American* beans. The most important single kind of bean is the eastern hemisphere's soybean, but the lima, sieva, Rangoon, Madagascar, butter, Burma, pole, curry, kidney, French, navy, haricot, snap, string, common, and frijole bean are all American. Often called the “poor man's meat.” American beans are especially rich in protein, as well as in oils and carbohydrates.[12]

When the European arrived in America, the American beans already existed in varieties suitable to almost every climate, and they were so obviously superior to many Old World pulses that they quickly spread to Europe, Africa and Asia.[13] Because they have often been a private garden crop rather than a field crop, they have escaped the official censuses; when they

are listed in censuses, they are often grouped under the general heading “Pulses” with a number of other kinds of beans. Their importance defies exact statistical description, but that importance is still there. Any world traveler will tell you that the visitor-from-far-away may be treated to gormet delights for his first few meals in a strange new country, but eventually he will find himself confronted—in Norway, Siberia, Dahomey, and Australia—with a plate of beans—American beans.

Of all the more important American foods, manioc is the least known to the inhabitant of the temperate zone. He knows it best by the name tapioca, under which title it arrives on his table as dessert. To add to the confusion, it is also known as manihot or cassava. To the North American and European manioc is a specimen of rare and exotic flora, but it is as important a contribution to the food supply of the tropics as maize or potatoes is to the temperate zones.[14]

The manioc plant is a large shrub which is usually harvested when no more than five to twelve feet high, although it can grow to eighteen feet. Its young shoots and leaves can be and often are eaten, but it is chiefly valuable for its roots, which, at harvest, are usually one to two feet in length and two to six inches in diameter and weight one to five kilograms or more.[15] From the eater's point of view (though not necessarily from the botanist's), there are only two kinds of manioc, sweet and bitter. Sweet manioc can be eaten fresh, but bitter manioc contains lethal quantities of prussic acid and must be processed before eating. The basic process of changing it from a poison into a food has not changed since it was developed by the American Indian, so let us draw on Roger Barlow's description of it, presented to Henry VIII over four hundred years ago. The Indians, Barlow wrote, take the manioc root,

> and rubbe it on a stone and so it turneth to curdes, which thei take and put in a long, narowe bagge made of ryndes of trees, and so press out the liquor and gather it in a vessell, and when the iuce is out ther resteth in the bagge the floure as fyne and white as the snowe, wherof thei make cakys and bake them upon the fier in a panne, and after this be bakyn it is a very good brede, holsome and medecinable, and will endure a yere without corruptyng. And likewise thei take the licour and seethe it over the fyre and after that it is a good drynke and of grete sustenaunce and strength, but and if one shuld drinke of it before it were boiled over the fire, and litle quantite as wold into a nuttys shelle, thei suld die incontynent.[16]

Manioc prospers from sea level to seven thousand feet and in soil too poor to support almost any other important crop: in parts of the Bas-Congo it is claimed that manioc will yield five tons per hectare of land too infertile for maize. It ignores drought and pests that destroy other crops. Although it is composed chiefly of starch and contains little protein or fat, it has significant amounts of certain vitamins and other nutriments. And, above all, it generally will produce more food by weight per unit of land than any other tropical plant.[17]

All that manioc asks of man and nature is a frost-free climate, dirt that is neither saline nor swampy, and from twenty to two hundred inches of rain a year! No wonder it has become one of the staple crops of the tropics. Since Columbus first saw it, it has spread around the

waistband of the globe. Between thirty degrees north and thirty degrees south it fills bellies from Sumatra to the Congo to its homeland, Brazil.[18]

The last few pages make it apparent that a switch from Old World to New World crops often means an improvement in food supply. The improvement, when it exists, is not always simply quantitative but often qualitative. Attempts to ferret out information on the quantities of various foods raised in the world can often lead to egregious errors, because our statistics are poor. Attempts to discover the average world *quality* of foods can lead to what amounts to science fiction, but perhaps if we only ask a single simple question about the most easily measured nutritional quality and do not allow ourselves to become too confident about the validity of the answer, we can obtain useful data. What is the average yield in calories per hectare of the world's major plant foods? (This question implies a disregard for the vital role that proteins, vitamins, minerals, etc., play in man's alimentation. However, it is crudely true that if man's caloric intake is sufficient, he will somehow stagger to maturity, and he will reproduce.) The answer to the question is provided in Table 2 (beans are purposely omitted because Old and New World varieties are grouped together by statisticians and nutritionists alike), which also shows the magnitude of the contribution of the American Indian agriculturalist.

But let us not substitute numerals for reason. The above statistics serve to describe an utterly mythical entity: the average world hectare under the influence of the average world weather. The variety of soils and climates in this world is enormous. There are vast areas of the globe where it would be much more calorically fruitful to plant oats than maize or potatoes, no matter what the averages say. But it is just that variety that made American food plants such a valuable addition to the cultigens of the Old World. Indian plants increased the variety of plants which the Old World farmer could try to match to the variety of soils and weather in order to coax nourishment out of nature.

TABLE 2
VARIETIES OF OLD AND NEW WORLD STAPLES[19] (in millions of calories per hectare)

Chief American Crops		Chief Old World Crops	
Maize	7.3	Rice	7.3
Potatoes	7.5	Wheat	4.2
Sweet potatoes and yams*	7.1	Barley	5.1
Manioc	9.9	Oats	5.5

As the Old World farmer expanded the area under his cultivation and tried to increase production per unit of land, he discovered that he had an enemy who grew stronger and stronger as the generations passed: the problem, of diminishing returns. Even the steppes of Russia do not have an endless capacity to produce wheat. For generations the Chinese have had no large undeveloped areas suitable for rice cultivation, unless they leveled mountains.

The great advantage of the American food plants is that they make different demands of soils, weather and cultivation than Old World crops, and are different in the growing seasons in which they make these demands. In many cases the American crops do not compete with Old World crops but complement them. The American plants enable the farmer to produce food from soils that, prior to 1492, were rated as useless because of their sandiness, altitude, aridity, and other factors. In many areas, because of their different requirements for sunlight or rainfall or other factors, they have enabled the farmer to eliminate the fallow season when the soil yields no food for man or his animals, thus employing unused labor power to good purpose and enormously increasing production. Arthur Young's note on the importance of maize in southern France in the 1780s illustrates this point:

> Where there is no maize, there are fallows: and where there are fallows, the people starve for want. For the inhabitants of a country to live upon that plant, which is the preparation for wheat, and at the same time to keep their cattle fat upon the leaves of it, is to possess a treasure.[20]

Let us turn now to the various areas of the Old World where American crops are important sources of food, to see if the record of history discloses when they became important, and if the population began to grow at about the same time. Our claims for the validity of our findings will be modest: we know that even if both trends began simultaneously, a cause and effect connection between the two cannot be taken as fact. We know that the agricultural and demographic histories of most of the areas under examination have yet to be written, much less correlated. We know that we are *not* demographers and have none of their skills and special knowledge: we will be sketching out a hypothesis—that is all. We know that we will be attempting the patently absurd—a bird's eye view of Europe, Africa, and Asia since 1492! But the big questions are really the only ones worth considering, and colossal nerve has always been a prerequisite for such consideration.

It would seem that the logical place to turn to first for evidence of the influence of American food on the Old World would be Europe, for the Europeans were the first from the eastern hemisphere to establish permanent contact with the New World. It is true that some American foods have been so thoroughly adopted by the Europeans that one cannot imagine what their national diets must have been like before Columbus. What would Mediterranean dishes be like without chiles, or the eastern European diet without paprika, that condiment derived from the chile pepper? Who can imagine the Italian chef deprived of the tomato?

The American crops of primary importance in Europe have been beans, maize, and, above all, potatoes. The bean, as usual, defies the searcher for precise information. The assumption that it was cultivated in Europe in the sixteenth century, spread rapidly and became an important part of the diet by the eighteenth century, is almost certainly correct, but information on where and when the bean became important and how important it became is hard to come by. The haricot bean was in Europe at least by 1542, for in that year the botanists Tragus and Leonard Fuchs described and sketched it. It was probably grown in appreciable quantities in

France by the end of the century; otherwise, why would the Englishman, Barnaby Googe, write of it as the "French bean" in 1572? String beans and lima beans were among the chief products of seventeenth-century Spain. John Locke, traveling on the Continent in 1678, suggested: "Take the leaves of kidney beans … and put them under your pillow or some convenient place about your bed. They will draw all the puneses [bedbugs] and keep you from being bit."[21]

The saga of the bean in Europe is obscure, but we can be sure that its cultivation was widespread in the eighteenth century. A Gallic botanist summed up its significance in a book published in the first year of the French Revolution, describing the common American pulse (*Phaseolus vulgaris*) as "cultivated almost everywhere because of the use that is made of its fruits in the cuisine."[22]

The bean spread to almost all the latitudes of Europe, but the impact of maize was and is restricted almost entirely to the southern half of that continent because this plant thrives only where granted several months of good hot weather. Today it is a crop of great importance in a band stretching across Europe from Portugal through northern Italy, Yugoslavia, the Danube valley, and into the Caucasus. But the Europeans were slow to take it up, possibly because Europe entered a cold period in the 1550s that lasted until the eighteenth century, and most certainly because most Europeans did and still do agree with John Gerard, who wrote in 1597:

> We have as yet no certaine proofe or experience concerning the vertues of this kinde of Corne, although the barbarous Indians which know no better are constrained to make a vertue of necessitie, and think it a good food: whereas we may easily judge that it nourisheth but little, and is of a hard and euill digestion, a more convenient food for swine than for man.[23]

Indeed, Hungarians, whose biggest single crop is maize, feed it almost exclusively to livestock, a policy which most European maize growers have tended to follow from the first.[24]

Yet millions of Europeans have lived on a diet based on maize in the last four hundred years, and continue to do so today. Maize was grown here and there in sixteenth- and seventeenth-century Europe, but its importance as a staple over large areas generally dates from no earlier than the end of the latter century. John Locke, in the south of France in the 1670s, observed "plots of Maiz in several parts, which the country people call *bled d'Espagne*, and, as they told me, serves the poor people for bred." In the eighteenth century it continued to spread, becoming a basic element in the southern French diet, and, to hazard a guess, perhaps figured in the renewed growth of the French population after the decline that marked the first decades of the century. The name for maize that the "country people" gave Locke suggests that maize was important in Iberia at least as early as his continental exile. Arthur Young, the agricultural expert and journalist, saw it again and again in the fields of northern Spain a hundred years later, and travelers in Portugal in the same era noted that it was *the* staple of the peasant there. During the seventeenth century Spain's population had declined; in the eighteenth it began to increase. Maize was cultivated very early in the Po Valley—some say even *before* Columbus—and when Goethe made his famous Italian journey in the 1780s he

discovered that polenta, a kind of corn meal mush, was the staple of the north Italian peasant's diet. Maize must have played some sort of role, at least in the north, in Italy's recovery from the population decline that occurred in the second half of the seventeenth century. Even the few wisps of information presented in this paragraph indicate that no one should make final judgments on the demographic history of the Mediterranean peoples in the eighteenth century without inquiring into the effect of the increase in maize production.[25]

Maize is more important in southeastern than southwestern Europe today, Yugoslavia and Rumania being among the biggest maize producers in the world.[26] Its importance in the Balkans and environs seems to date from no earlier than the beginning of the eighteenth century. Geographers and travelers, writing about the Balkans in the seventeenth century, make little or no mention of maize. Then, as population pressure began to rise in the eighteenth and nineteenth centuries, the cultivation of maize and other American crops, such as squash and potatoes, began to expand. The case of Hungary is a good example. As the Turks were driven out of Hungary, thousands of immigrants entered and a slow transition from a society of cattle grazers to one of farmers took place. By the end of the eighteenth century the chief product of the eastern half of Hungary was maize. Chiefly because of Hungary, the Hapsburg empire was Europe's leading maize producer in the nineteenth century.[27]

Maize and other American food plants were known and raised at least to some extent all over the Balkans by 1800. Then, in the nineteenth century, population grew very rapidly in the Balkans, a phenomenon which was both a cause and an effect of the cultivation of American foods, among other factors. Many of the peoples—the Serbs are a clear example—followed the example of the Hungarians, changing from pastoralist to agriculturalists and, in the process, they took up maize as a staple food.[28]

Rumania is a classic case for anyone searching for Old World examples of the importance of American foods. Maize may not even have been introduced into Rumania until the eighteenth century; certainly it had no importance there before that century. Yet, by the last decades of the nineteenth century, Rumanians were almost as devoted to and dependent on maize as Mexicans. Rumanians raised wheat and maize, the former to export, the latter to eat. Maize, which pairs so well with wheat in crop rotation, enabled Rumania to become one of Europe's breadbaskets. Mamaliga, a maize porridge, became and remains the Moldavian peasant's staff of life, “the principle or sole item of every meal.” And when the same peasant celebrates, he drinks spirits made from maize, even as the Tennessee mountaineer.[29]

No other Balkan nation adopted maize so wholeheartedly as Rumania, but by 1900 it and other American plants were established as important crops throughout the peninsula. At the end of the nineteenth century one expert on the Balkans described the typical Macedonian village as consisting of “unpicturesque houses, surrounded by fields of maize, and gardens rich in such unromantic vegetables as the pumpkin.”[30] Potatoes also abounded, especially in the mountains, but maize was, over all, the single most important American crop. This remains true, although the dependence on maize as food for humans is decreasing, along with population pressure. Strong echoes of the past remain, however. Joel Martin Halpern, in his book, *A Serbian*

Village, notes that the poorer peasants of Orašac still eat maize rather than wheat bread, and, on their few hectares, raise maize rather than wheat because of the former's superior yield. The vegetable gardens of Orašac, by the way, with their peppers, snap beans, tomatoes, potatoes, pumpkins and squash, would make an Aztec's mouth water.[31]

Maize has had an important influence on population growth in southern Europe, but it cannot be credited with being one of the primary causes of the general European demographic expansion of the last two hundred years, which has had such awesome effects on world history. That population explosion is the result of many factors, not the least of which has been medical advance. Another factor of no minor significance has been Europe's love affair with the common American potato.[32]

Sixteenth-century European documents mentioning the potato are of very little help to us because the same word was often used to indicate potatoes and/or sweet potatoes. This, however, is of no great significance because neither had any importance except as novelties and aphrodisiacs! Said Shakespeare's Falstaff in a moment of passion, “Let the sky rain potatoes.” A few years later a lesser playwright put these words in the mouth of one of his characters: “I have fine potatoes, Ripe potatoes! Will your Lordship please to taste a fine potato? 'Twill advance your wither'd state, Fill your Honour full of noble itches.”[33]

For long after the initial century of acquaintance, the mass of Europeans looked upon the potato with fear and contempt. Many, for instance, were sure it caused leprosy. Others thought it a very dreary, plebian sort of food. Diderot's *Encyclopedia*, that monumental production of the eighteenth century avant-garde, declares that no matter how the potato is prepared, “this root is insipid and mealy. It cannot be classed among the agreeable food stuffs, but it furnishes abundant and rather wholesome nutrition to men who are content to be nourished. The potato is justly regarded as flatulent, but what are winds to the vigorous organs of peasants and laborers?”[34]

Threats of rot and gas could not forever conceal from Europeans the significance of the fact that potatoes could produce more “wholesome nutrition” from the average piece of land in the northern half of Europe than any other crop. It was the Irish, of course, who first wholeheartedly adopted the potato. It came to their island sometime in the last years of the sixteenth century, and within a hundred years the Irish were known as “mighty lovers of potatoes.” In 1724 Jonathan Swift, with typical bitterness, described his countrymen as “living in filth and nastiness upon buttermilk and potatoes.” The moist, cool atmosphere and deep, friable soils of Ireland are perfect for the potato, and the Irish, condemned by foreign rule to the depths of poverty, could have asked God for no better gift than the potato. As the crop spread in Ireland, the population grew, which made further spread of the tuber almost compulsory, for no other plant could feed so many Irishmen on such small plots of earth. One-and-a-half acres, planted with potatoes, would provide enough food, with the addition of a bit of milk, to keep a family hearty for a year. It was not exceptional for an Irishman to consume ten pounds of potatoes a day and very little else. On this diet the Irish, without benefit of medical science, hygiene, industrialization, or decent government, increased from 3.2 million

in 1754 to nearly 8.2 million in 1845, not counting the 1.75 million who emigrated before 1846. Then came the potato blight, the failure of the Irish staple, and one of the worst famines of modern times. The Irishmen who had lived by the potato died by the potato.[35]

In few other parts of Europe were the conditions of demography, soil, and weather such as to produce such total commitment to the potato as in Ireland; however, the commitment elsewhere became, in time, at least comparable. As population expanded and industrialization drew more and more people into the cities, the potato assumed greater and greater importance in the diet of the eighteenth- and nineteenth-century English peasant and laborer.[36] The number of articles in English journals on potatoes, potato bread and potato cultivation increased noticeably as even the English upper classes became conscious of the population pressure. Typical is an 1803 article in *The Annual Register* entitled, "Observations on the Means of Enabling a Cottager to Keep a Cow by the Produce of a Small Portion of Arable Land." It called for the planting of three-and-one-quarter acres of land in potatoes, turnips, a grain crop, and clover in rotation. The "potatoes shall go for the maintenance of the cottager and his family" and the rest for the cow and to sell for cash income.[37]

On the Continent the peasant, it seems, was more hesitant about the potato, but the tuber's advantages and the pressures to extract more nourishment from the land had the same effect in many areas as in the British Isles. The potato spread, roughly speaking, from west to east, with the French and Germans (the latter more wholeheartedly than the former) taking up its cultivation a generation or so after the English. On the continent the adoption of the potato was more a matter of conscious government policy than in Great Britain. The potato was served at the royal table in France, and Marie Antoinette wore its flowers as a corsage to advertise its virtues. In Prussia Frederick the Great urged its cultivation. After the famine of 1772 in Hungary, the government ordered that potatoes be grown, despite the fact that they were practically unknown in that land. Again and again, as in Hungary, we find potato production spurting upward after famines, in spite of the fact that the peasants "attributed every possible mischief to potatoes." By the end of the eighteenth century the potato was already under cultivation in eastern Europe. In the first years of the next century Alexander von Humbolt accurately referred to that "beneficent plant" as already indispensable for a large part of the people of the colder lands of Europe.[38]

In the nineteenth century, while potato production climbed precipitously in western and central Europe, the Slavs of eastern Europe also wholeheartedly adopted the plant. A famine and epidemic in 1765 persuaded Catherine the Great of the potential importance of the tuber to Russia, and her government launched a campaign to encourage its cultivation. However, the potato did not become a major crop in central Russia until after the crop failures of 1838 and 1839. Russia was one of the world's top producers of potatoes by 1900. In the last forty years of the last century, her potato production went up over 400 percent. Some of these potatoes went for industrial use, but most went to feed Russians, the number of which increased by 70 percent in the same period. Today Russia leads all other nations by a wide margin as a producer of potatoes.[39]

Even if Russian production is excluded entirely, it is still true that in mid-twentieth century half the world's potatoes were spaded out of the soil of Europe. The European could well add to his liturgies the prayer first heard by white men in Peru in the sixteenth century:

> O Creator! Lord of the ends of the earth! Oh, most merciful! Thou who givest life to all things, and hast made men that they might live, and eat and multiply. Multiply also the fruits of the earth, the papas [potatoes], and other food that thou hast made that men may not suffer from hunger and misery.[40]

The importance of American foods in Africa is more obvious than in any other continent of the Old World, for in no other continent, except the Americas themselves, is so great a proportion of the population so dependent on American foods. Very few of man's cultivated plants originated in Africa—only 50 out of 640, according to Vavilov—and so Africa has had to import its chief food plants from Asia and America. This has been especially true in the rain forest areas, for practically none of the jungle food crops is native to Africa.[41]

Those Africans who owe most to the American Indian are the Eastern Nigritic people, who populate an area, very roughly speaking, from Nigeria east to the center of the continent, and who raise maize, manioc, peanuts, various squashes, pumpkins, and sweet potatoes. Nearly everywhere else in Africa, American crops are of *at least* secondary importance, and the total African production of these foods is enormous. One authority claims that Africa produces 5 or 6 percent of the world's maize, 25 percent of her peanuts, and—by an estimation perhaps too enthusiastic—50 percent of her manioc and 50 percent of her sweet potatoes and yams. (The statisticians have paired these last two in a geographically improper fashion).[42]

These proportions are higher now than in the past, but American foods have played an important role in Africa for a long time. Tropical Africa lies in the same latitudes as South America, and so crops transferred from one to the other had a minimum of adaptation to undergo. Furthermore, the trans-Atlantic slave trade, which was initiated by men of the Columbus generation, promoted a significant transfer of flora from the Americans to Africa sooner than from the former to Europe. To illustrate, easily preserved food was needed in quantity to feed the human cargoes on their way to the New World. What better way to provide for this need than to plant maize, so easily preserved from corruption by drying, on the slave coasts of Africa?

The bean, tomato, sweet potato, various cucurbita, cacao, and peanut play and have played very important roles in Africa. The last two are especially important as export crops. But maize and manioc rank as the most important of American foods consumed in Africa. Maize was under cultivation in West Africa at least as early as the second half of the sixteenth century, and perhaps even earlier.[43] The chief grains of Africa before the sixteenth century were probably millet and sorghums, which yield considerably less than maize in the wet tropics; and so maize spread rather rapidly in the rain forest areas. The seventeenth-century Dutchman, Olfert Dapper, declared that there was an abundance of maize in the Gold Coast and "it grows profusely. They bake it, with or without mixing it with millet." Its tall green stalks

were also to be seen to the south, on the Congo and Angola coasts, and the people of the interior were adopting it in the same century. Oral tradition indicates that maize first came to the Bushongo people of the south-central Congo basin in the seventeenth century.[44]

By 1900 maize could be found almost everywhere in Africa, except for Uganda, exceeding in production all other grains but rice in the jungles, the savanna regions, and along the rivers; and successfully competing with millet and sorghums in many of the drier areas. The Boers, as they trekked north from Cape Colony in the early nineteenth century, found the South African Bantu already planting and harvesting maize. Today maize, or "mealies" as it is called in South Africa, is the staple of the Bantu diet. South Africa is one of the world's greatest producers of maize and about seventy percent of its total crop area is devoted to that American plant. In our century cultivation of maize has continued to spread, and maize has become, for the first time, a mainstay of diet for most of eastern and central tropical Africa.[45]

Even more impressive than the spread of maize in the last hundred years has been that of manioc. The latter's ability to grow in nearly any kind of soil, its resistance to African pests, and its enormous productivity in weight of food produced per unit of land have endeared it to the African farmer. An especially admirable quality is its resistance to drought, a common phenomenon in the grasslands that compose most of sub-Saharan Africa. In the mid-twentieth century manioc is a staple or supplemental food to the people of almost every area south of the Sahara and Ethiopia and north of the Zambezi.[46] So common has it become that West Africans, according to a recently returned Peace Corps worker, insist that the plant is native to Africa.

It is not. It originated in South America and was probably brought by the Portuguese to the Congo and Angola in the sixteenth century and around the Cape to Madagascar and Mozambique in the eighteenth. Manioc was much slower to spread than maize, possibly because of ignorance of or lack of faith in the process for leeching out its poison. Except for the Congo, manioc was not a staple crop in any widespread area of Africa before 1850. However, despite the Africans' hesitation, it did spread into the interior and was grown throughout most of its present range by 1900. In our century African production of manioc has shot upward. Nigeria, for instance, raises more manioc than any other food.[47]

The rapid rise in African population following 1850 (see Table 1) not only coincides with the spread of political stability and modern medical techniques—alleged characteristics of the growth of the European colonial empires—but also with the accelerated spread of maize, manioc and the other American foods. As for the influence of these crops before 1850, we might hypothesize that the increased food production enabled the slave trade to go on as long as it did without pumping the black well of Africa dry. The Atlantic slave traders drew many, perhaps most, of their cargos from the rain forest areas, precisely those areas where American crops enabled heavier settlement than ever before.

There is no area in which the story of American foods is as obscure and yet as vital to the understanding of world history as in the Middle East. Maize and other American plants seem to have arrived in the Middle East in the sixteenth century.[48] Whenever they arrived in the Middle

East, we can be sure that the people of that area played a very important role in their dissemination to other parts of the world. There is little documentary or archeological proof for this as yet, but there is an impressive body of linguistic evidence. Early European names for maize, some of which still prevail, are *granoturco, blé de Turquie, Turkisher Korn, Turkie wheat,* and *trigo de Turquia.* Many names for maize in the Indian subcontinent—*Mecca, Makka, Makkaim makaī, mungari*—indicate either that it is a food from Mecca, meaning God, or, more likely, that it originally reached India from some Islamic region. Careful examination of the words for maize in the languages and dialects of Africa yields strong evidence that the plant came to the Africans not only directly across the Atlantic but also from Egypt via the Lake Chad region and from Arabia via Zanzibar, Madagascar and Mozambique. When Napoleon was in Egypt at the end of the eighteenth century the Egyptians were calling maize "wheat of Turkey" or "wheat of Syria." If the Old World beginnings of maize are as Middle Eastern as these bits of evidence seem to indicate, then perhaps so are the beginnings of other American crops suitable to the climates of the Middle East.[49]

Dr. Leonhard Rauwolf, a sort of proto-botanist who journeyed through the Middle East in the 1570s, wrote an account of his adventures in which he tells us of kidney beans, French beans, and Indian millet (maize) "six, seven or eight cubits high" on the banks of the Euphrates and in the fields around Aleppo and Jerusalem. A specimen of maize that he collected in the Euphrates valley in 1574 exists today in a Leyden herbarium.[50]

Indeed a claim that American food plants did not find their way to the Middle East before 1600 would deserve little support. They were present in all the other chief divisions of the Old World by that date: why not in the Middle East? The Ottoman Empire was the most important Middle Eastern and Mediterranean power in the sixteenth century, drawing all things to it, just as all things today are drawn to Russia or the United States. The Ottoman Empire was undergoing rapid population growth, which inclines any people to experiment with new crops. The expansion of the Ottomans into the Balkans and their control and influence over the Asian and Sudanese caravan routes enabled any item newly popular with the Turks, including food plants, to spread far and wide very rapidly. However, the fact that European travelers in the Middle East in the seventeenth and eighteenth centuries made little, if any, mention of maize and other American crops confuses and undermines any generality we may dare to make.[51]

Today the American crops are of only secondary importance in the Middle East, except for Egypt, where the mass of the *fellaheen* are clearly dependent on maize to keep them from famine. Maize may have reached Egypt very early in the sixteenth century, but it did not become a staple crop until the eighteenth century. By the last decades of that century it was already an important source of food, and its importance has increased ever since.[52]

The population figures for Egypt in the first three quarters of the nineteenth century are very poor, but we can be sure that there was a steady rise which has continued and even accelerated since. In 1882 Egypt had 6.7 million people; in 1907, 11.2 million; in 1935, 16 million; and, in 1964, 28.9 million.[53] There has been some territorial expansion of Egypt in this time, but most of the population rise has come from natural increase stemming not only from medical

advances but also from the expansion of maize production, without which the present population could not exist.

The rich soil, the plentiful water of the Nile, and the hot sun make maize the nearly perfect crop for Egypt. No other grain crop produces such yields in this environment, and the labor costs of cultivating maize in Egypt are lower than those of any other grain. Today a greater area is devoted to maize than to any other food crop, and "maize forms the principal article of diet of the people."[54]

An examination of the role of crops raised for human consumption in the Far East is more worthwhile than for any other area because the pressure of population on the food supply has been so great for so long that East Asians probably depend less on animals as a source of nourishment than any other large group of people in the world. They cannot afford the extravagant practice of grazing cattle on arable land and then eating the cattle. They know that it is much more efficient, in terms of filling human stomachs, to raise food crops on the land, and let the livestock scavenge for their nourishment. For example, about 98 percent of the caloric content of the Chinese diet is of vegetable origin. In the phrase of Pierre Gourou, the Orient has a "vegetable civilization."[55]

As to the importance of changes and additions to the Orient's vegetable regimen, we can do no better than to quote Warren S. Thompson: "There can be no reasonable doubt that the amount of subsistence is still the chief factor in determining the level of the death rate in such countries as China and India. In the long view, Malthus was fundamentally correct when he said that man's growth in numbers was largely dependent on the supply of subsistence." The staple of the Far East is, of course, rice, but, considering the above quotation, of what significance is the fact that the production of maize and manioc, and probably other American crops, has increased faster in that enormous area in the first half of the twentieth century than that of rice?[56]

The population explosion in the subcontinent of India, as far as we can judge, does not extend farther back than the last decades of the eighteenth century. In 1600 Indians numbered between 100 million of and 125 million. By 1800 the number had changed little; our best estimate is 120 million. Then the awesome rise began: 130 million by 1845; 175 million by 1855; 194 million by 1867; 255 million by 1871.[57] Despite famine, plague, and war, the trend has continued. According to United Nations estimates of 1964, the population of the subcontinent, India and Pakistan combined, is over half a billion.

The beginnings of the population explosion dovetail neatly with the extension of British rule over all of India, bringing political stability, improvement in the transportation system, and at least some of the benefits of modern science. The population expansion also coincides with the widespread adoption of American foods in India. The relationship between the two trends is difficult to trace, for population grew rapidly in some areas where American crops were not raised, but that does not necessarily undermine the contention that they did affect population increase in areas where they *were* cultivated.

Such American fruits as pineapple and guava reached India and were cultivated in appreciable quantities as long ago as the sixteenth century, but they probably had little effect on population growth. These have never been staple foods for any large number of people. The great population builders among the American foods were first cultivated in quantity in the eighteenth century, and did not become major elements in the Indian diet until the nineteenth and twentieth centuries.[58] This seems to have been the case in most of the Eastern hemisphere: Europe, much of Africa and now India.

There is little indication that maize cultivation was widespread in India at the beginning of the nineteenth century, although we do find scattered documentary evidence of its local importance, such as in Kangra, where "the poor people live much on maize." Whatever the extent of its cultivation in 1800, we can be sure that it spread rapidly thereafter, largely displacing millets, as it was doing in the same period in Europe and Africa. By the last decades of the century maize was grown, at least in some quantity, throughout the length and breadth of India. The hill peoples were largely dependent on it, and in the north—in Punjab, the Northwest provinces and Oudh—maize was a staple article of food. George Watt, a British botanist, ventured to "speak of maize as of equal value to the people of India collectively with wheat." He further emphasized its importance (and, incidentally, pointed out one of the chief pitfalls of trying to write food history) by remarking, "So completely has India now appropriated the Makkal [maize] that few of the village fathers would be found willing to admit that it had not always been with them as it is now, a staple article of diet. They may even cite its supposed ancient names and quote wise sayings regarding it, oblivious all the while that a very few years ago these were universally accepted as denoting an altogether different plant." Little has changed since Watt's time, except that now even more maize is raised, and India has edged into the circle of top producers of maize of the entire world.[59]

The sweet potato plant never attained the importance of maize in India, but as Indians learned that it would grow in soil too poor for other crops, its cultivation spread through the hot lowlands, and its root became an item in the diets of all classes in India long before the twentieth century arrived. The Irish potato has usually been raised only as a mountain or winter crop, but it, too, has spread to all suitable parts of India, and its consumption is common, especially on fast days when Hindus are forbidden to eat grain.[60]

Manioc seems to have been a latecomer to India. Not until about 1850 did it become a common crop, but since then no competent writer on Indian alimentation has been able to ignore it. It soon became a staple in Assam, where a Major Jenkins wrote of it in the last century, "There is no barren waste or hill land about us in which this plant does not thrive." Its marvelous adaptability drew the Major's notice: "I have never seen it cultivated in fields or plots, but it appears to be just stuck in the hedges (for which, whilst it grows, it forms a useful post), and when wanted or at maturity, it is dug out."[61]

Manioc has attained greatest importance in southern India in the states of Travancore and Cochin, where it may actually be the principle staple. The reason for its wholesale adoption in these areas of dense population is obvious. Manioc yields the Indians 11.6 million calories per

hectare, as compared with 5.5 million and 5 million for paddy rice and maize respectively.

India has become the world's leading grower of peanuts, producing almost 5.3 million metric tons of peanuts in 1963, and they have become common in the diet, especially in southern India. The lima bean is to be found throughout India, as are the pumpkin and the squash. The pumpkin is often to be seen not only in the vegetable gardens of the lower classes, but even spreading over the roofs of their homes.[62]

Although an important source of vitamins, the chile pepper is not usually thought of as a really important item in the diet. It comes close to being just that in India. The American chile pepper was almost completely unknown in seventeenth-century India, began to spread in the eighteenth century, and is now the nearly indispensable ingredient in every Indian meal. The ubiquitous chutney and curry are unimaginable without American chile. George Watt wrote at the end of the nineteenth century that the chile pepper, "ground into a paste, between two stones, with a little mustard oil, ginger and salt …, form the only seasoning which the millions of poor can obtain to eat with their rice."[63]

The largest nation of southeast Asia in terms of population and land is Indonesia, the population of which has been growing rapidly for the last century and more, especially on the larger islands. In 1815 the population of Java and Madura was in the vicinity of 4.6 million. In 1890 it was almost 24 million. In 1960 the figure was approximately 62.5 million.[64] In the same century and a half there has been increasingly widespread cultivation of American food plants in Indonesia. A connection between the two phenomena is as certain here as anywhere in the world.

As is so often true of the Orientals, the staple of most Indonesians is rice, but for generations these people have been faced with the simple fact that most of the land suitable to rice and most of the obvious ways to increase rice production were utilized a long time ago. The Indonesian rice farmers and their counterparts in other areas of the Far East are, considering the climate, soils, and tools they have to work with, very good farmers. The amount of rice they can coax out of a hectare of paddy is immense, yet the increase in rice production over the last century or so is insufficient to have alone encouraged the population growth that has characterized the same period.

Amercian Indian food plants arrived in the East Indies practically as soon as the Europeans did. It is probable that the sweet potato arrived before the Europeans. American beans were grown there at least as early as the seventeenth century. As early as 1699, according to the explorer William Dampier, maize was a staple for the people of the coastal plains of Timor. In 1789 Captain William Bligh, late of H.M.S. *Bounty*, reeled ashore at the same island at the end of his epochal 3,600-mile voyage in an open boat, and the natives "brought us a few pieces of dried turtle and some ears of Indian corn." Some time around 1800 the Dutch introduced the Irish potato into the mountains of Java.[65]

In the last century secondary crops, most of them American—maize, manioc, sweet potatoes, peanuts, and chile peppers—have increased in importance relative to rice. This is

particularly true in the uplands of Indonesia, generally unfit for rice, where the population growth has equaled that of the coastal lowlands. Of these secondary crops, the most important, as in India, have been maize, manioc and sweet potatoes.[66]

Maize had little significance in the East Indies in the seventeenth century, but by 1800 it may well have become the most important secondary crop, at least in Java. John Crawfurd, in his *History of the Indian Archipelago*, published in 1820, stated that maize cultivation, pushed by population increase, was rapidly spreading, as land suitable for rice grew scarce. Since then, as population expansion has accelerated, so has maize production. In the mid-twentieth century maize ranks second in importance only to rice among the cereals in Indonesia as a whole, and is the staple food in parts of the Celebes, Timor, Lombok, East Java, and Madura.[67]

Manioc made its appearance in the East Indies at least as early as the seventeenth century but, as elsewhere in the world, was adopted rather slowly by local agriculturalists. But the increasing number of mouths calling for food and manioc's incredible productivity combined eventually to make its appeal irresistible. Considering that a portion of the rice crop must be preserved for the next year's seed, then manioc, no part of which need be preserved for planting but the inedible stalk, yields nearly twice as many calories per unit of land in Java as rice. It prospers in areas where only a fool would plant paddy rice and where even maize languishes, such as on the relatively arid limestone plateau of the Gunung Sewu of Java, where it is the chief crop. The United Nations statistics are very sketchy on manioc, but it is worth noting that they place Indonesia second only to Brazil, the homeland of the plant, as a producer of the root.[68]

Indonesia, also, ranks as one of the world's leading sweet potato producers, harvesting an impressive 2.6 million metric tons in 1962. The sweet potato is especially important as an “in-between” crop, like others among the American foods. When the rice of the last harvest is gone and that of the next has not yet arrived, the sweet potato becomes an indispensable source of nourishment for many Indonesians.[69]

Rice production has not been able to keep pace with population expansion on Java, especially in this century. The widening gap between the two has been filled by cultivating other foodstuffs in rotation with rice and back in the areas where the irrigation networks do not reach. In 1900 the people of Java had available to them, per capita, per year 110 kilogram (Kg.) of rice, 30 kg. of tubers and three kg. of pulses. By 1940 the propositions had changed: 85 kg. of rice, 40 kg. of maize, 180 kg. of tubers and about 10 kg. of pulses.[70] The difference between the two diets consists mostly of increased quantities of American foods in the year 1940.

There are many examples elsewhere in Asia of the importance of American foods to growing populations. Japan, for instance, lies too far north for manioc to thrive, and its people have never acquired a liking for maize, but American potatoes, sweet and white, have been an important part of their alimentation for many generations. The sweet potato spread to Japan from China, via the Ryukyu Islands, in the last part of the seventeenth century—so one story

goes. The tomb of the Japanese farmer who brought it home is known as the Temple of the Sweet Potato, and there every spring his grateful posterity make him offerings. The sweet potato has proved to be nearly unfailing famine insurance: in four years—1832, 1844, 1872, and 1896—large numbers of the Japanese found themselves depending on sweet potatoes for existence.[71]

The Irish potato has never been a successful rival to the sweet in most parts of Japan, but it does grow well in the colder areas. It arrived no later than 19 June 1615, when an agent of the English East India Company in Japan wrote, "I tooke a garden this day, and planted it with pottatos." Like so many others, the Japanese did not like the taste of the potato at first, but during the floods and famines of the 1680s discovered that potatoes made good cattle feed and would prosper in colder climates and higher altitudes than the sweet potato. Russian introduction of the plant into Hokkaido in the latter part of the century gave further impetus to its cultivation, and when Japan opened her gates to the world in the mid-nineteenth century, visitors found the potato a common item, especially in the north.[72]

The relationship in Japan between growth in population and in production of American foods is not as clear as it is in some other areas of the world, but it is worth taking into consideration. In 1950 Japan raised far more rice than any other food—over 8.5 million metric tons of rice on family farms alone—but these same farms also produced over 4.6 million metric tons of sweet potatoes and over 2.2 million metric tons of Irish potatoes.[73] She is the world's second largest producer of sweet potatoes, which are the staff of life on Okinawa. It is unlikely that any other food plants available to the Japanese could produce the yields that the sweet and Irish potatoes do in the soils in which the Japanese plant them.

The largest producer of sweet potatoes in the world is China. More is known of the impact of American foods in China than in any other area we have examined because of Ping-ti Ho's splendid book, *Studies on the Population of China, 1368–1953;* it is from this work that most of the following remarks have been drawn. Population statistics for China are notoriously vague, and the definition of precisely what is and what is not China has changed so often and is so controversial that perhaps it is an act of self-deception to pay too much attention to exact figures. For as long as man has tried to keep exact records, China's population has been huge, and its growth over the last few centuries has been colossal. In 1661 she had something like 100 million people; in 1900 something like 400 million; and today the Communist regime claims over 687 million subjects.[74]

The Chinese existed in enormous numbers in the seventeenth century chiefly because of their successful exploitation of the rice plant, particularly of the fast maturing varieties first introduced in the eleventh century, which allowed double-cropping. The majority of the Chinese were people of the plains, pinned to the wet lowlands by their dependence on rice. In fact, there is evidence that even as late as 1700 the Chinese farmer had left largely untouched the dry hills and mountains of the northern two-thirds of China. But although the Chinese concentration on growing rice brought vast returns—rice production doubled between the years 1000 and 1850—the problem of diminishing returns became more and more apparent.

China's mothers seemed to have a capacity to produce an infinitude of babies, but her land did not have the capacity to produce an infinitude of rice. Rice and the traditional dry land crops—wheat, millets, and such—could not by themselves have encouraged or enabled China to launch into the upward sweep of population growth that has created as many Chinese today as there were human beings in the entire world two and a half centuries ago. The stable government of the Manchu dynasty undoubtedly was a factor in the seventeenth and eighteenth century, but chaos has been the rule for China's last and most awesome century of population growth; and the life-saving techniques of modern science, the most commonly credited cause of population expansion, are only now beginning to be applied in the rural areas.[75]

No large group of the human race in the Old World was quicker to adopt American food plants than the Chinese. While men who stormed Tenochtitlán with Cortés still lived, peanuts were swelling in the sandy loams near Shanghai; maize was turning fields green in south China and the sweet potato was on its way to becoming the poor man's staple in Fukien.[76]

By the late eighteenth and early nineteenth century maize had become the primary food crop in large areas of the uplands of southwest China. As the valleys of the Yangtse River and its tributaries filled up with people in the eighteenth century, the excess population, forced up into the hills and mountains, found that maize was the key to extract subsistence from the previously barren highlands. The northern Chinese farmer was slower than his southern brothers to take up maize, not cultivating it in quantity until the nineteenth century, but today something like one-seventh of all the food energy in north China is provided by maize. China, which harvested 16,849 million metric tons of maize in 1952–1953, stood second only to the United States as a producer of that food in that year. And, as is the case in Egypt, India and Indonesia, and decidedly not the case in the United States, nearly all China's maize feeds humans, not animals.[77]

However important maize is to China, the sweet potato is an even greater boon. It arrived at least as early as the 1560s and was adopted rapidly because it did not compete with rice and other traditional crops, but prospered in previously unutilized soils, such as the rocky Shantung coast, the rice-deficient southeast provinces and the drought-ridden highlands. By the eighteenth century the sweet potato, its cultivation urged by official edicts, was spreading into nearly every climatically hospitable corner of China. Its admirers have increased ever since, and, next to rice and wheat, the sweet potato is China's most important crop. It is the traditional food of the poorest classes: in fact, to be called a sweet potato eater was an insult in pre-communist China. China is far and away the world's greatest producer of sweet potatoes, averaging at least 18.5 million metric tons a year between 1931 and 1937.[78]

China's agricultural output is so great that she ranks high as a producer of crops which are clearly of secondary importance to her. For example, in the years 1948 through 1952 she produced over 12 million tons of potatoes annually, about as much as the United States. The potato was grown in Fukien before 1800, but since has become most important in the high mountain areas, where it is a staple, and on the high plains of Kansu, Inner Mongolia and Manchuria.[79]

China harvested 2.4 million metric tons of peanuts in 1962–1963, and bows only to India as a producer of this food. Peanuts play a much more important role in China than we who only nibble them at ballgames realize. The plant enables the Chinese peasant to make greater use of the sandy coastal and riverline soils than was ever possible before the sixteenth century, and the peanut even plays an important role in the crop rotation in some rice districts. The peasant, although he has never heard of nitrogen-fixing nodules, does realize that growing peanuts helps to preserve the fertility of the soil. Today peanuts are known throughout China and are a common food in the north.[80]

The impact of American crops on China has, according to Ping-ti Ho, been simply enormous. Rice accounted for perhaps seventy percent of China's total national food output in the early seventeenth century. By 1937 the percentage had dropped to about thirty-six percent. In the last three centuries the dry land crops, such as wheat, millet, maize and sweet potatoes, in contrast to rice, “have increased to about sixty-four percent, and American food plants alone to approximately twenty percent, of the total national food production.” “During the last two centuries,” Ho continues, “when rice culture was gradually approaching its limit, and encountering the law of diminishing returns, the various dry land food crops introduced from America have contributed most to the increase in national food production and have made possible a continual growth of population.”[81]

According to United Nations statistics for world agricultural production in 1963, the crops most heavily produced are as shown in Table 3. (The political situation is such that these figures omit the production of Albania, mainland China, Mongolia, North Korea, and North Vietnam.)

If China's agricultural output were included in these statistics, their order might well be different, but the importance of the plants first cultivated by the American Indian would still be obvious. The statistics would seem to suggest that something like one third of the plant food raised to feed man and his animals in the world today comes from plants of American origin.

TABLE 3
LARGEST WORLD CROPS IN 1963
(in million metric tons)[82]

Potatoes	277.6
Rice	257.4
Wheat	250.3
Maize	231.8
Barley[a]	102.9

[a] Below barley the amount produced of each crop drops off sharply.

Perhaps the world food production would be sufficient to support the present world population if potatoes, maize, etc., had never existed and the fields they occupy were planted

in Old World crops, but I think the reader will agree that that is a very large "perhaps." It seems more likely that the number of human beings on this planet today would be a good deal smaller but for the horticultural skills of the neolithic American.

NOTES

1. Dennis, H. Wrong, *Population and Society*, 13.

2. William H. McNeill, *The Rise of the West*, 627–628, suggests the Columbian exchange as one of the chief causes of the population explosion. The exchange of diseases between and within the Old and New Worlds at first limited population growth; then, as resistance to those maladies built up all over the globe, the population began to expand: "age-old epidemic checks upon population faded into merely endemic attrition."

3. Dorothy S. Thomas, *Social and Economic Aspects of Swedish Population Movements, 1750–1933*, 83–84.

4. George Carter, "Plant Evidence for Early Contacts with America," 162–182; George Carter, "Plants Across the Pacific," 62–71; George Carter, "Maize to Africa," 3–8; Carl O. Sauer,, "Maize into Europe," 777–778; Thor Heyerdahl, "Merrill's Reappraisal of Ethnobotanical Evidence for Prehistoric Contact Between South America and Polynesia," 789–796.

5. Nikolai Ivanovich Vavilov, *The Origin, Variation, Immunity and Breeding of Cultivated Plants*, 44. See also C. D. Darlington, *Chromosome Botany and the Origins of Cultivated Plants*, 132–180.

6. Vavilov, *Cultivated Plants*, 39–43.

7. Uncultivated plants, such as cacti, made the journey from the New to the Old World, also, but their impact seems less than that of their Old World counterparts on the New. As always, "weeds" take hold when the ecology of a given area has been disturbed. Henry N. Ridley found Singapore Island to be entirely covered with dense forest in 1822. Man had stripped the jungle off by his return in 1888, and he found a number of alien invaders among the new growth: "thirty-nine came from South America and the West Indies, nineteen from other parts of tropical Asia, three from China, seven from Africa, four from Europe, and fourteen were typical weeds now so widely distributed that their homes of origin is uncertain." Henry N. Ridley, *The Dispersal of Plants Throughout the World*, 639.

8. Vance Bourjaily, "The Corn of Coxcatlán," 55; Richard S. MacNeish, "Ancient Mesoamerican Civilization," 531–537; Paul C. Mangelsdorf, Richard S. MacNeish, Walton C. Galinat, "Domestication of Corn," 538–545.

9. Food and Agricultural Organization of the United Nations, *Production Yearbook, 1963*, 17: 37–38, 46–48; David Mitrany, *The Land and the Peasant in Rumania*, 304.

10. Désiré Bois, *Les Plantes Alimentaires Chez Tous les Peuples et á Travers les Ages*, 1:

331; William L. Langer, "Europe's Initial Population Explosion," 11; Cecil Woodham-Smith, *The Great Hunger: Ireland 1845–1849*, 30; Berthold Laufer, *The American Plant Migration*, part I: *The Potato*, 11.

11. FAO *Production Yearbook, 1963*, 52, 79; Ping-ti Ho, *Studies on the Population of China, 1368–1953*, 186; A. Hyatt Verrill, *Foods America Gave the World*, 46, 48; Ruth McVey, ed., *Indonesia*, 131.

12. Herbert J. Spinden, "Thank the American Indian," 331; Wilbur H. Youngman, "America —Home of the Bean," 228; Carl O. Sauer, *Agricultural Origins and Dispersals*, 65; W. R. Arkroyd, *Legumes in Human Nutrition*, vi, 38, 109; Artemas Ward, *Encyclopedia of Food*, 29; Bois, *Plantes Alimentaires*, 1: 142.

13. Sauer, *Agricultural Origins*, 66.

14. William O. Jones, *Manioc in Africa, 4.*

15. William O. Jones, *Manioc in Africa*, 5.

16. Roger Barlow, *A Brief Summe of Geographie*, 154–155.

17. Jones, *Manioc*, 4, 6, 256; Donald D. Brand, "Tapioca from a Brazilian Root," 93.

18. Brand, "Tapioca," 93–94; Jones, *Manioc*, 15.

19. These figures are obtained by multiplying the yield statistics in kilograms in the FAO *Production Yearbook, 1963*, passim, by the caloric value statistics in the FAO *Food Composition Tables for International Use*, passim.

20. Arthur Young, *Travels During the Years 1787, 1788 and 1789*, 2: 41.

21. Bois, *Plantes Alimentaires*, 1: 142; Rafael Altamira, *A History of Spain*, 470; John Locke, *Locke's Travels in France, 1675–1679*, 207.

22. Jean Lamarck, ed., *Encyclopédic Méthodique, Botanique*, 3: 71.

23. Paul Weatherwax, *Indian Corn in Old America*, 45–47; C. E. P. Brooks, *Climate Through the Ages*, 310.

24. Márton Pécsi and Béla Sárfalvi, *The Geography of Hungary*, 251; Lamarck, *Encyclopédie Méthodique*, 3: 682; Food and Agricultural Organization, *Maize and Maize Diets, A Nutritional Survey*, 62.

25. Locke, *Travels*, 236; Jorge Nadal, *La Población Española* (*Siglos XVI a XX*), 20; J. W. Goethe, *Italian Journey, 1786–1788*, trans. W. H. Auden and Elizabeth Mayer, 20; Young, *Travels*, 1: 643, 645, 647, 650, 2: 353; *Annual Register* (1810), 52: 672; Sauer, "Maize into Europe," 777–778; Marion I. Newbegin, *Southern Europe, a Regional and Economic Geography*, 181; J. H. G. Lebon, *An Introduction to Human Geography*, 123–124; Edmond Soreau, *L'Agriculture du XVIIe Siècle à la Fin du XVIIIe*, 103, 179; D. V. Glass and D. E. C. Eversley, eds., *Population in History*, 455, 472, 573; Marcel R. Reinhard and André Armengaud, *Histoire Générate de la Population*, 144.

26. *The Statesman's Yearbook, Statistical and Historical Annual of the States of the World for the Year 1964–1965*, xix.

27. Elisee Reclus, *Universal Geography*, 3: 145; Henry Marczali, *Hungary in the Eighteenth Century*, 46, 50, 55; Reinhard and Armengaud, *Histoire Générdle*, 179.

28. J. E. Worcester, *A Geographical Dictionary or Universal Gazetteer*, 2: 101, 788; L. C. Vialla de Sommières, *Voyage Historique et Politique au Montenegro*, 2: 75; Mitrany, *Rumania*, 304; L. S. Stavrianos, *The Balkans Since 1453*, 420; Doreen Warriner, ed., *Contrasts in Emerging Societies: Readings in the Social and Economic History of South-Eastern Europe in the Ninetheenth Century*, 298, 300, 308, 322, 326, 354, 368.

29. Mitrany, *Rumania*, 305; Bernard Newman, *Balkan Background*, 95; Eugène Pittard, *La Romanie*, 147–149; Reclus, *Universal Geography*, 1: 147.

30. Charles Eliot, *Turkey in Europe*, 328.

31. Joel Martin Halpern, *A Serbian Village*, 57–58.

32. Langer, "Population Explosion," 1–17.

33. As quoted in Redcliffe N. Salaman, *The History and Social Influence of the Potato*, 424, 425, 428.

34. As quoted in Laufer, *Potato*, 62–63.

35. Salaman, *The Potato*, 135, 189, 190, 251; Woodham-Smith, *The Great Hunger*, 30; Langer, "Population Explosion," 12.

36. Langer, "Population Explosion," 14; B. H. Slicher Van Bath, *The Agrarian History of Western Europe*, a.d. *500–1850*, 267.

37. *Annual Register* (1803), 45: 850–853.

38. Slicher Van Bath, *Agrarian History*, 268; Langer, "Population Explosion," 14; Marczali, *Hungary*, 55–56; Alexander von Humbolt, *Voyage de Humbolt et Bonpland, Première Partie Physique Générale, et Relation Historique du Voyage*, 1: 29; Warriner, *Contrasts*, 66.

39. Worcester, *Geographical Dictionary*, 2: 466; Langer, "Population Explosion," 15–16; Peter I. Layshchenko, *History of the National Economy of Russia*, 453; FAO *Production Yearbook, 1963*, 76.

40. FAO *Production Yearbook, 1963*, 76; Quoted from Salaman, *The Potato*, 102.

41. Vavilov, *Cultivated Plants*, 44; L. Dudley Stamp, *Africa: A Study in Tropical Development*, 142; Sauer, *Agricultural Origins*, 34; Roland Oliver and J. D. Fage, *A Short History of Africa*, 28.

42. George Peter Murdock, *Africa, Its People and Their Culture History*, 223, 233–234 and passim; George Petter Murdock, "Staple Subsistence Crops of Africa," 522–540; Roland Portères, "L'Introduction du Maïs en Afrique," 221; William A. Hance, *The Geography of Modern Africa*, 9.

43. Some even claim that maize was present in Africa prior to Columbus's voyages. Few, as yet, accept this view, which, of course, does not mean that it is incorrect. For those interested in further reading on this theory, George Carter's "Maize to Africa" is a good place

to start.

44. Marvin P. Miracle, “The Introduction and Spread of Maize in Africa,” 39, 41, 44, 45.

45. Marvin P. Miracle, “The Introduction and Spread of Maize in Africa,” 52; S. M. Molena, *The Bantu, Past and Present*, 118; William J. Burchell, *Travels in the Interior of Southern Africa*, 1: 225; Hance, *Geography of Modern Africa*, 547; Marvin P. Miracle, “Murdock's Classification of Tropical African Food Economies,” 219–244.

46. Jones, *Manioc*, 3, 16.

47. Jones, *Manioc*, 38; W. B. Harrison, Review of *Manioc in Africa*, by William O. Jones, 159; R. J. Harrison Church, *West Africa, A Study of the Environment and Man's Use of It*, 489; Miracle, “Murdock's Classification,” 219, 224.

48. There are those who think that maize was grown in the Middle East before the sixteenth century and that Arab sailors were in contact with America as early as the ninth century. See M. D. W. Jeffreys, “Pre-Columbian Maize into Africa,” 965–966.

49. Portères, “Maïs en Afrique,” 99; *Déscription de l'Egypte ou Recueil des Observations et des Recherches qui ont été faites en Egypte Pendant l'Expédition de l'Armée Française*, 19: 55.

50. John Ray, ed., *Collection of Curious Travels and Voyages Containing Dr. Leonhart Rauwolf's Journey into the Eastern Countries*, 2: 50, 72, 124, 130, 133–134, 187, 189, 215; Karl H. Dannen-feldt, *Leon Rauwolf*, 97, 254.

51. Ömer Lufti Barkan, “Essai sur les Données Statistiques des Registres de Recensement dans l'Empire Ottoman aux XVe et XVIe Siecles,” 27; Spinden, “Thank the American Indian,” 331; John Payne, *Universal Geography*, 1: 335, 415; Henry Blunt, *A Voyage into the Levent*, passim; Chevalier Chardin, *Voyages de Chevalier Chardin en Perse et Autres Lieux de l'Orient*, passim.

52. Reader Bullard, ed., *The Middle East, a Political and Economic Survey*, 55; Vivi and Gunnar Täckholm, *Flora of Egypt*, 1: 546; J. D. Tothill, *Agriculture in the Sudan*, 319; Charles Issawi, *Egypt at Mid-Century, An Economic Survey*, 20; Payne, *Universal Geography*, 1: 453; Helen Anne B. Rivlin, *The Agricultural Policy of Muhammad 'All in Egypt*, 158.

53. Marcel R. Reinhard, *Histoire de la Population Mondiale de 1700 à 1948, 446–441*.

54. Issawi, *Egypt*, 111; W. B. Fisher, *The Middle East*, 468.

55. Pierre Gourou et al., *The Development of Upland Areas in the Far East*, 1: 8.

56. Warren S. Thompson, “Population,” 11; V. D. Wickizer and M. K. Bennett, *The Rice Economy of Monsoon Asia*, 208ff.

57. Kingsley Davis, *The Population of India and Pakistan*, 24, 25.

58. Irfan Habib, *The Agrarian System of Mughal India, 1556–1707*, 38, 47–48, 56.

59. George Watt, *A Dictionary of the Economic Products of India*, 6: 334–335; *Statesman's Yearbook, 1964–1965*, xix.

60. Watt, *Products of India*, 4: 479–482, 6: 266; Laufer, *Potato*, 91.

61. Watt, *Products of India*, 5: 159; Jones, *Manioc*, 25, 33.

62. Statistical Office of the United Nations, *Statistical Yearbook, 1964*, 138; Watt, *Products of India*, 1: 286, 2: 639.

63. Watt, *Products of India*, 2: 137.

64. Nitisastro Widjojo, *Migration, Population Growth, and Economic Development in Indonesia: A Study of the Economic Consequences of Alternative Patterns of Inter-Island Migration*, 6, 254.

65. I. H. Burkhill, *A Dictionary of the Economic Products of the Malay Peninsula*, 2: 1709, 2047–2048; Charles Robequain, *Malaya, Indonesia, Borneo and the Philippines*, 95; William Bligh, *The Mutiny of H.M.S. Bounty*, 193; Laufer, *Potato*, 95.

66. McVey, *Indonesia*, 125; Gourou et al., *Upland Areas*, 2: 53.

67. Gourou et al., *Upland Areas*, 1: 74–75; McVey, *Indonesia*, 120; Burkill, *Products of the Malay Peninsula*, 2: 2280.

68. Burkill, *Products of the Malay Peninsula*, 2: 1413; Jones, *Manioc*, 25; McVey, *Indonesia*, 17; FAO *Production Yearbook, 1963*, 81–82; Clifford Geertz, *Agricultural Involution: The Process of Ecological Change in Indonesia*, n. 92.

69. MvVey, *Indonesia*, 131; Gourou et al., *Upland Areas*, 2: 84–85.

70. Geertz, *Agricultural Involution*, 96.

71. J. S. Cooley, "Origin of the Sweet Potato and Primitive Storage Practices," 328–329; Berthold Laufer, "The American Plant Migration," 244–245.

72. Peter Pratt, *History of Japan Compiled from the Records of the English East India Company, at the Instance of the Court of Directors*, 2: 60; Laufer, *Potato*, 81–82; Rutherford Alcock, *The Capital of the Tycoon, A Narrative of Three Years Residence in Japan*, 245, 263; Henry Dyer, *Dai Nippon*, 242.

73. FAO *Report on the 1950 World Census of Agriculture* [no pagination].

74. L. Carrington Goodrich, *A Short History of China*, n. 202; Kenneth S. Latourette, *A Short History of the Far East*, 714.

75. William Peterson, *Population*, 372–373.

76. Ho, *Population of China*, 183–184.

77. Ho, *Population of China*, 187–189; John King Fairbank, *The United States and China*, 127; FAO *Production Yearbook, 1963*, 47; FAO, *Maize and Maize Diets*, 62–63.

78. Ho, *Population of China*, 186–187; Iago Galdston, ed., *Human Nutrition, Historic and Scientific*, 68.

79. *Statesman's Yearbook, 1964–1965*, xxi; Ho, *Population of China*, 189.

80. Ho, *Population of China*, 184–186.

81. Ho, *Population of China*, 184, 191–192.

82. United Nations, *Statistical Yearbook, 1964*, 21.