

I. b.2 Hurt, R. Douglas. “Mesoamerican Origins”

from *Indian Agriculture in America*

Simply put, agriculture means raising things on purpose, and the American Indians were the first farmers in the Western Hemisphere. At least seven thousand years before the English colonists founded the settlement of Jamestown in Virginia, the Indians of Central America and Mexico, an area commonly known as Mesoamerica, tilled the soil, planted seeds, and harvested crops. This is not to suggest, however, that those Indians cultivated a multiplicity of crops in vast fields; instead, they depended upon hunting and gathering for nearly all of their subsistence needs. Agriculture met only a small portion of their daily food requirements. Nevertheless, they were beginning the long transition from living primarily by hunting and gathering to residing in settled farming communities. Millenniums passed, however, before they completed that dramatic cultural change.

Over time, the nomadic Indians of Mesoamerica learned the advantages of clearing away unwanted plants in order to enhance the growth of others. This rudimentary weeding process created a new, artificial environment for favored cultigens, which caused genetic changes in these plants and increased their productivity. With these revelations, the basic premise of agriculture had been discovered: planting, cultivating and harvesting--the agricultural process--provided a much more dependable food supply. As a result, large bands of Indians could settle in a specific area for a long period of time.

Current archaeological evidence cannot pinpoint a single location where Indian agriculture began or determine precisely why the Indians became agriculturists. Rather, the archaeological record suggests that the cultivation and domestication of plants originated simultaneously in several Mesoamerican areas. Some of the most complete evidence for early agricultural development comes from the Mexican state of Tamaulipas and from the Tehuacan Valley, located in northeastern and south-central Mexico, respectively. Indian farmers may have first raised bottle gourds (*Lagenaria siceraria*) as early as 7000 B.C., in the Tehuacan Valley and in Oaxaca; Tehuacan Valley farmers were perhaps the first to domesticate corn; and Indians may have originally cultivated pumpkins in Tamaulipas. Concurrent agricultural development is important, because it indicated that Indian farmers attempted to meet their own food needs according to the dictates of their own environment.

In the late nineteenth and early twentieth centuries, archaeologists believed that agriculture began in the rain forests, where the Indians learned to cultivate root crops. No knowledge of complex food processing was needed to prepare the roots for consumption, because many roots could be eaten raw, roasted, or steamed over a fire. Certainly, the development of agriculture based on root crops would have been a relatively simple process, requiring only a fire-hardened digging stick. Although this location for agricultural development existed in the intermediate altitudes of Mesoamerica. There, in the Tehuacan Valley, archaeologists have found some of the earliest evidence of cultivated plants. As a result of those discoveries, they have traced the evolution of a nomadic people, who depended on hunting and gathering to a civilization that became dependent on agriculture.

The Tehuacan Valley was well suited to be a center of agricultural development in the Western Hemisphere. Soil and moisture conditions enabled Indian farmers to practice agriculture. The semiarid climate of the valley was an asset, because it had prevented the growth of vegetation. Indian farmers could plant without giving a great deal of attention to clearing the land and to fighting continuous battles with unwanted vegetation that would compete for soil nutrients and moisture. Tehuacan farmers probably planted their crops on the most alluvial fans at the end of the water courses that spread out from the hillsides. Such sites had several advantages for early farmers. First floodwaters periodically removed much of the unwanted vegetation. Second, torrents of water from heavy rains washed fertile soil down from the hillsides and replenished the richness of the alluvial fans. Third, when the runoff was minimal, the water irrigated the growing plants. Finally, subsurface moisture watered the crops even in the absence of surface runoff.

No abrupt shift occurred from food gathering to plant raising as the Tehuacan people became more dependent upon a stable agricultural economy. There, as in the regions that are today the Mexican states of Oaxaca, Morelos, and Guerrero and the Basin of Mexico, the Indians, through many millenniums of observing nature, had learned to manipulate their environment by encouraging the growth of certain plants, by removing competing weeds, by clearing the land, and by planting and harvesting. Gradually the cultivation of plants became more important as the Indian farmers throughout the valley adopted more of them. From time to time, they added new plants and improved others through the careful selection of the best seeds. Greater agricultural productivity and a wider variety of domesticated plants meant that the Indians needed less time for hunting and gathering and therefore had more time for clearing land, planting, weeding and harvesting.

The Tehuacan people probably became committed to the agricultural process during the Coxcatlan cultural phase of Mesoamerican civilization (5200-3400 B.C.). During that period the Indians became more dependent on plants, seeds, and fruits. The Coxcatlan people grew corn; the tepary, the black and perhaps the common bean; chili peppers; avocados; amaranth; bottle gourds, and two kinds of squash. Each spring, these agriculturists probably came together into large groups or macrobands, to plant their favorite seeds and to eat the fruits of their labors throughout the summer months until they exhausted the surplus. Then they broke up into small family groups, or microbands, for an autumn and winter of hunting and gathering.

During the Abejas phase (3400-2300 B.C.), Tehuacan farmers raised enough food to provide a surplus, which could be stored for use during the fall and winter months, when they traditionally had depended almost entirely upon meat from the hunt. This surplus probably was not enough to enable all of the Indian bands in the valley to remain at the spring and summer campsite year round, and some no doubt moved away to hunt and gather roots and seeds during the autumn and winter. Still, agricultural production enabled some Tehuacan families to live in permanent villages. Agriculture became so important that those families who moved away from the winter returned to the campsite in the spring to plant their seeds alongside those Indians who had remained. In short, agriculture enabled the Indians of the Tehuacan Valley to adopt a more sedentary life. Indian farmers continued the intensive cultivation of small garden plots of corn, beans, chili peppers and squash, but they also began to farm large areas or fields once they had become sedentary.

Between 900 B.C. and A.D. 700, Mesoamerican agriculture became more complex. The Tehuacan people cultivated corn and added runner beans (*Phaseolus coccineus*) to their cultivation practices. They also adopted tomatoes, lima beans, peanuts, guava, and domesticated turkeys. In addition to raising a wide variety of plants, the Tehuacan farmers also developed supplementary industries closely related to agriculture, such as salt making and cotton processing. During that period, lowland farmers probably conducted slash-and burn, also known as milpa or swidden agriculture, while farmers in the drier areas practiced intensive irrigation farming.

Independent agricultural development also occurred in Tamaulipas, on the northeastern periphery of Mesoamerica. During the Infiernillo cultural phase (7000 to 5500 B.C.), Indian farmers cultivated pumpkins and gourds. Pumpkins provided a very small part of their diet, but the Indians supplemented this food with wild runner beans and chili peppers. Between 2200 and 500 B.C., during the Flacco, Almagre, Guerra, and Mesa de Guaje phases, these Indians became more sedentary as agriculture became increasingly important. They raised corn, sunflowers, squash, and possibly manioc. Between 1500 B.C. and A.D. 900 the Tamaulipas farmers added new domesticates or cultigens--lima beans, squash (*Cucurbita mixia*) tobacco (*Nicotiana rustica*) and cotton.

In contrast to the farmers in the dry Tehuacan Valley and southern Tamaulipas, the Maya people in the region of present day Guatemala, Belize and Honduras developed a complex agricultural economy in the rain forests. Indeed, by approximately 1200 B.C. the Mayan people were practicing agriculture, and by 500 B.C., it provided their primary food source. These Maya farmed either extensively or intensively depending upon the amount and the quality of available land. They cleared lands by the slash and burn method, and they raised fields from the swampy lowlands. In the open clearings, Maya farmers used a dibble stick to poke a hole in the soil to plant seeds. The topsoil in this region is shallow, varying from a few inches to approximately a foot in depth; and an underlying bed of limestone leaches the nutrients from the soil. This causes soil exhaustion soon after the land has been cleared; nevertheless, Maya farmers cultivated fields intensively for as long as this was profitable. When soil depletion caused decreased yields, more land had to be cleared. By allowing the weeds to cover worn-out land, the Maya conducted a form of soil, rather than crop, rotation. As long as suitable new lands were available for clearing, this farming method met their needs.

The Maya farmers' ability to support a relatively large population from small cultivated plots did not negate the need for large amounts of land. Because the tropical soil became quickly exhausted, the farmers abandoned their croplands every two or three years. They continually cleared new agricultural land and allowed depleted lands to reforest. While four years might be enough to rest the soil after a single crop, if two successive plantings were made, the land might be allowed to lie fallow for six or seven years. Maya farmers often abandoned their plots for fifteen to twenty years ---on occasion, for thirty or forty-five years---in order to enable the nutrients to build up in the soil once again. Because the Maya did not have domesticated animals and apparently did not fertilize with human excrement, they could not effectively maintain soil fertility on an extensive basis. Still, this field-rotation system was ideally suited for tropical soils. The return of weed growth reduced soil erosion in a region of heavy rainfall, and the subsequent burning of secondary growth provided the potash needed to help restore soil fertility. While this

land-use methods certainly depleted the soil, Maya farmers learned that it permitted the consistent production of food necessary to sustain their civilization.

Slash-and-burn agriculture was not the only Maya land-use method. Maya farmers also practiced raised-field, or chinampas, agriculture on a large scale. Water covered much of the land during the rainy season, and to cultivate the land effectively and intensively. Maya farmers dug drainage canals and built a series of stone terraces, perhaps as early as 200 B.C. Behind those terraces, they added marl to raise the agricultural plots about one meter above the water level. These raised fields provided several advantages. First, the moist soil of these plots was ideal for seed germination. Second, the soil was sufficiently pulverized and aerated to allow deep root penetration. Third, because topsoil and muck from surrounding drainage ditches formed the raised fields, the soil was extremely fertile. Maya farmers also built hillside terraces, which helped hold organic material on the slopes and thereby retarded soil erosion.

The time, expense, and organizational requirements needed to build an extensive raised-field system dictated the intensive farming of those lands. Furthermore, a large labor force was needed to farm the land and to maintain the terraces, ditches, and stone walkways of the raised fields. For these reasons, the raised and terraced fields of the Maya may have been the most productive and intensively farmed lands in Mesoamerica. Moreover, the Maya were skilled farmers who cultivated a wide variety of plants: beans and squash--which they intermixed with the corn--sweet potatoes, manioc, tomatoes, avocados, cacao, chili peppers, cotton and other crops.

Later after the Aztec occupation of the Valley of Mexico during the thirteenth century A.D., farmers in that area used slash and burn as well as irrigation techniques. In the Xochimilco-Chalco Basin, however, Aztec farmers also practiced chinampas agriculture by raising field from swampy lands. There the Aztecs built raised fields or gardens by carrying sod into the marshes with canoes. Actually, these plots were nothing more than ridges that varied from approximately two to three meters in width. Each farmer planted crops on a number of ridges, then used a canoe to go to the plot. The marsh water irrigated the roots even during the dry season. From surrounding canals, these Aztec farmers obtained muck, rich in organic nutrients which they applied to their plots. In addition, they fertilized the ridges with a compost of aquatic weeds; they may have applied human excrement as well.

While some chinampas farmers lived on the edge of the swamp, most of them resided in island towns such as Mizquic, Cuitlahuac and Xochimilco. Small villages and scattered houses also stood on foundations among the cultivated ridges. Although the ridge, or chinampas, field system probably began in this region before the birth of Christ, its development did not peak until A.D. 1400-1600. Overall, these Aztec farmers possibly reclaimed more than 120 square kilometers of swamp. After excluding the canals from that estimate, chinampas farmers had more than 9,000 hectares, composed of winding ridges, available for cultivation. Long before the Spanish Conquest, then, Aztec farmers had developed an intricate land use system that provided the basis for a highly productive agricultural economy.

Ultimately, these Mesoamerican farmers cultivated a wide variety of small grains, legumes, squashes and fruits. The squash-bean-corn complex furnished the staple nutritional base,

however; and plants in the squash family may have been domesticated first. Archaeological evidence also indicates that these farmers domesticated cucurbits (squash) in several distinct areas. Perhaps as early as 5000 B.C., in Tamaulipas, they raised *Cucurbita pepo*, commonly known as either summer squash or pumpkins. Indian farmers probably domesticated *Cucurbita moschata*, a winter squash or pumpkin, about 4000 B.C. in what is now the Mexican state of Puebla. The area of Oaxaca and Chiapas may have been the center or place of origin of the cultivation and distribution of *Cucurbita mixta* as early as 3000 B.C. The bottle gourd, one of the first plants to be domesticated, however, may have been raised first in the Ocampo cave region of Tamaulipas and at Guila Naquitz in Oaxaca as early as 7000 B.C. The cultivation of cucurbita indicates that Mesoamerican farmers practiced very conservative crop husbandry, because they tended to raise the same squashes for many generations.

Beans were the second staple in the food complex. Mesoamerican Indians domesticated the common bean (*Phaseolus vulgaris*) about 5000 B.C. in the Tehuacan Valley and about 4000 B.C. in Tamaulipas, though they did not raise it abundantly until agriculture became well established in Mesoamerica. Archaeologists have found the oldest--approximately 200 B.C.--evidence of domesticated runner beans near the Coxcatlan cave in the Tehuacan Valley. Runner beans probably were not domesticated there first because of the hot, arid environment. The beans discovered in the valley may have come into the area through trade with farmers in the humid uplands, possibly from Guatemala. Mesoamerican farmers also started to grow small-seeded lima or sieva beans (*Phaseolus lunatus*) soon after the start of the Christian Era in Tamaulipas and in the Tehuacan Valley as well as on the Yucatan Peninsula. In the Tehuacan Valley, they also raised tepary beans (*Phaseolus acutifolius*), which they did not adopt until about two thousand years after they began to cultivate common beans. Tehuacan farmers apparently raised teparies for about three thousand years before this cultigen disappeared from the cropping system for some unknown reason. Perhaps those farmers either reaped greater harvests from the common bean or disease ruined the crop. No one is certain.

Beans were an important agricultural crop for Mesoamerican farmers, one that contributed an important part to the nutrition of the people of that region. Indeed, these four species of beans were closely associated with the cultivation of corn, and Indian farmers may have domesticated some varieties of beans and corn at the same time. Beans have an abundant supply of lysine, an amino acid necessary for good health. Corn lacks both lysine and the amino acid tryptophan. Beans complement corn by adding these two amino acids to zein, the amino acid in corn, thus creating a protein of high nutritional value. This union of amino acids occurs with any combination of corn and beans. While Mesoamericans lacked a scientific explanation, about seven thousand years ago they recognized that a combination of corn and beans provided a healthy diet, and thereafter, both crops remained basic to their agricultural process. Because of insufficient archaeological evidence, no one can yet state precisely when Mesoamerican farmers first cultivated beans or when they began making careful selections for the development of specific varieties. Nor can anyone identify the origins of these cultigens. Beans, however, were important to Mesoamerican agriculture, and they spread northward to become just as significant to the Indian farmers within the continental United States.

Corn, the most important Mesoamerican cultigen, also remains a "mystery" crop, although archaeological work has provided some insights into its origin. Archaeologists have not yet

absolutely determined the ancestor of today's corn, but some have contended that it was a now-extinct wild corn. Others insist that corn developed from a related wild grass known as teosinte. Multiple origins for the domestication of corn may exist, and the Tehuacan Valley probably was one center. Warm temperature and a rainy season from April through October provided ideal circumstances for seed germination after the dry winter months. Archaeologists have recovered prehistoric corn from five caves--Coxcatlan, Purron, San Marcos, Teccoral and El Reigo--in the Tehuacan Valley, which show the evolutionary development of the plant over a period of sixty-five hundred years.

The earliest corn yet discovered has been dated at approximately 5000 B.C. from the Tehuacan Valley, but no clear evidence exists to indicate that the Indians practiced agriculture in this region at that time. In fact, no one is certain when or where Mesoamerican farmers began cultivating this plant. Between 3400 and 2300 B.C., during the Abejas cultural phase of Mesoamerican civilization, corn became part of the agriculture of the region and Indian farmers were raising it along with bottle gourds, squashes, tepary, common and jack beans, chili peppers, and avocados. By 900 B.C., corn provided the basis for irrigation projects, large villages, and more extensive agriculture than ever before. It was a dietary staple for Mesoamericans by that time.

Overall, then, Mesoamerican farmers were superb plant breeders. Even though they did not understand the precise principles of heredity or hybridization, they used their skills at seed selection to improve their corn crops. These farmers changed corn from a multistock to a single stock plant. This enabled the plant to produce greater yields and also made harvesting easier. By selecting seed from plants that branched the least and had the fewest long ears. They also planted their corn in hills and continued to heap the soil around the plants during cultivation. This process discouraged the growth of sucker branches that would weaken the plant and prevent it from reaching maximum productivity. Strong, healthy plants produced the best seeds, which the Indians used during the next planting season. While the Mesoamerican Indians did not control pollination and probably did not understand how it worked, they discovered that when they crowded corn plants into a relatively small area, the plants tended to produce not only a single stem but also an excellent condition for cross-pollination. The result was a plant that had a high tolerance for inbreeding. Although the archaeological record proves that Mesoamerican farmers were expert corn breeders, no one can yet say with certainty just how they knew what they knew, because they did not leave a written record for study; but they obviously knew that their method of seed selection for corn worked. The corn grew, and they achieved better crops with stronger plants that produced larger ears and bigger harvests. Further improvements in corn production would not come for more than five thousand years.

Not only did Mesoamerican farmers become highly skilled at clearing forested lands, at raising fields from marshlands, at domesticating a wide variety of plants, and at breeding a number of varieties of corn, they also developed a sophisticated irrigation system. For example, by the Santa Maria cultural phase of Mesoamerican civilization (900 to 200 B.C.), Tehuacan farmers were busy with the painstaking process of selecting and raising improved avocado trees, which did not bear fruit for seven years but did require irrigation during that time. At first, these farmers probably planted avocado trees along the banks of streams and dug irrigation ditches to water the trees during the dry season. Small dams, dating from 800 to 600 B.C., also impounded

runoff and stream flow for irrigation; they indicate an increasing technological sophistication. In time, canals were developed to transport water from dependable sources--a technique that these farmers evidently preferred, since they did not emphasize the construction of dams to impound large amounts of water. By approximately 200 B.C., large irrigation projects dotted the Tehuacan Valley; and from then until the Spanish Conquest, Tehuacan farmers irrigated most of their crops.

In the Valley of Oaxaca, in the southern Mexican highlands, canal irrigation was impractical, because the springs and streams could not provide enough water. Here, as early as 700 B.C., Indian farming using "pot-irrigation" which involved digging shallow wells that the farmers drew water from with jugs. The water table was only about three meters below the surface, so wells could be dug with little difficulty. They provided enough water so that Oaxaca farmers could plant three corn crops annually. While this system was not practical in the Tehuacan Valley, where the water table was too deep, it was ideal in the Valley of Oaxaca. The individual farmer could dig his own wells, so a highly organized labor system was not required for the construction of extensive irrigation canals.

On the eve of the Spanish Conquest, if not before, Indian farmers in northwestern Mexico's valley of Senor also practiced irrigation farming. They diverted the runoff from heavy rains across small agricultural plots in the arroyos of the valley. Stone and dirt terraces slowed the runoff sufficiently to irrigate the crops while also allowing the silt in the water to settle on the fields, thereby increasing soil fertility. Those prehistoric Indian farmers also diverted streams on the flood plain of the valley floor by constructing weirs out of branches and soil. Their weirs diverted part of the stream into irrigation ditches, which channeled the water among the plants in the fields.

Mesoamerican agriculturists emphasized the cultivation of plants, rather than the raising of animals. With the possible exception of the domestication of turkeys and dogs in North America and the llama in South America, the prehistoric Indian farmers of the New World paid almost no attention to raising animals or fowl. Mesoamerican farmers, nevertheless, were highly skilled. They made specific adaptations to local environmental problems by developing irrigation systems in the dry Tehuacan Valley and elsewhere by building raised fields in areas too wet for cultivation, and by growing the kinds of plants that produced the most abundant harvests. As their food production increased, the farmers met the growing demands for food by expanding the size of their fields if similar lands were readily available; or by intensively farming the lands already under cultivation if they could not acquire more suitable land.

By 1000 B.C. the Mesoamerican people were full-time farmers who were producing enough food so that large numbers of people could form permanent villages and develop distinctive cultures and civilizations based on agriculture. Although cultivated fields generally did not extend farther beyond the villages than the farmers could walk both ways in a day and still work the variety of plants that the Mesoamerican farmers domesticated and cultivated was very large: corn; common, tepary, jack and lima beans; pumpkins; squashes; chili peppers; amaranth; cacao; tomatoes, and avocados provided both staple foods and seasonings. The farmers understood and practiced the principles of selection, irrigation and terracing--all with the aid of stone tools for

clearing, planing and cultivating. They also raised surplus crops and stored grain in underground pits or granaries.

Without a doubt, no single “hearth” or center of agricultural origin exists in Mesoamerica, nor did this region experience an agricultural “revolution” during the prehistoric period. The development of agriculture evolved as Indian farmers acquired, synthesized, and applied their knowledge of cultivation, domestication, and plant breeding. The evolutionary development of agriculture in that region gave the Indians increasing control of their environment and altered their lifestyles dramatically. Agriculture made food supplies more certain, decreased starvation and want, improved nutrition and made possible the development of villages and complex civilizations. Given the absence of modern science and technology, the achievements of the Mesoamerican agriculturists are nothing less than astonishing. Far to the north in what is now the continental United States, Indian farmers later built on those achievements.