Charcoal, Isotopes, and Shell Hoes

Reconstructing a 12th Century Native American Garden

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Corn-based agriculture was established among the Fort Ancient Indians in the central Ohio River valley by the 11th century A.D. Beginning in 1778, the Dayton Museum of Natural History set out to reconstruct the sort of garden the Fort Ancient Indians would have grown at SunWatch Village, an A.D. 1180 stockaded settlement located in what is now Dayton, Ohio (see box on the excavations). Charred plant remains, gardening and food production artifacts and features, and the results of human bone studies from this site, combined with similar information from nearly 50 other Fort Ancient sites, have provided direct and indirect archaeological evidence for what was grown.

The goal of our efforts is not so much to replicate Fort Ancient gardening practices as it is to re-create the plants themselves (Fig. 1). The gardening techniques we follow are derived from historic accounts and descriptions of fields and gardening. The types of crops we grow are based on archaeological evidence, and our program of breeding is guided by comparison between the modern varieties and the archaeological evidence.

Life in the 12th Century

The Fort Ancient Indians, whose culture flourished from A.D. 850 to 1650, established permanent villages along the Ohio River drainage system in what is now central and southern Ohio, northeastern Kentucky, southeastern Indiana, and western Pennsylvania (Fig. 4). Their villages typically were arranged in an orderly fashion, with the cemetery, houses, and underground food storage pits laid out around a central public plaza. A stockade or fence often surrounded the village, which was home to several hundred inhabitants. The villages appear to have been independent and self-supporting, unlike the settlements of contemporary Mississippian groups to the west which were unified into regional networks under an overarching political authority.

Even though the Fort Ancient people relied heavily upon a few food plants and meat animals, they supplemented and spiced their diet with a wide variety of less important foods (Shane 1988). White-tailed deer and elk frequently accounted for over 85 percent of the meat in their diet, with the remaining 15 percent supplied by black bear, raccoon, turkey, squirrel, turtle, fish, and other animals.

Fort Ancient farmers raised corn, beans, pepo squash, gourds, sunflower, tobacco, and chenopod (goosefoot), but they also gathered a variety of wild nuts, fruits, greens, small-seeded annuals, and roots. Corn (Zea mays) was an important component in the Fort Ancient diet, as actual corn remains are ubiquitous and often abundant at Fort Ancient villages, and associated small seed assemblages indicate the high degree of vegetational disturbance associated with agricultural fields. By way of comparison, corn is absent or infrequent at preceding early Late Woodland (A.D. 900-1200) sites in the same area, and the associated weed assemblages are smaller and more varied.

Excavations at SunWatch Village

Sunwatch Village (originally named the Incinerator Site for a nearby landmark) was brought to the attention of James M. Heilman, Curator of Anthropology at the Dayton Museum of Natural History, by John C. Allman. Allman, a local amateur archaeologist, urged that something be done about this nearly undisturbed single component Fort Ancient site. Other Fort Ancient sites had been excavated as early as the 1890s, but this was one of only a very few that did not contain a bewildering sequence of multiple occupations, nor had it yet been encompassed and destroyed by urban sprawl. Destruction, however, was imminent due to plans to expand a nearby sewage treatment plant. Already a road ran through the east side of the site. Excavation and subsequent reconstruction of the site were carried out by the Dayton Museum under Heilman’s direction.

The artifacts that had been brought to the surface by plowing were limited to a roughly circular area, leading Heilman to surmise they delineated a stockaded village. Salvage excavations (1971-1973) confirmed that this was, indeed, a stockaded village with only a single occupation period of approximately 40 years or less. Better yet, the preservation of fragile remains was phenomenal for an open site that had been exposed to 500 years of rain, freezing temperatures, and other natural destructive forces. The excavators were able to recover delicate artifacts such as infant bones, crawled pinches, fish scales, turkey eggshells, and bits of uncarbonized (but collapsed) wood. The site was placed on the National Register of Historic Places, and with the cooperation of the City of Dayton and the sewage treatment plant, plans for destruction were discontinued.
less indicative of large, open fields. The switch to dependence on corn occurred between A.D. 1750 and 1850, a period for which we lack excavated sites in this region.

**SunWatch Village**

SunWatch Village occupies a low terrace in the floodplain about 200 m west of the present course of the Great Miami River, at the southern edge of the city of Dayton. The site itself is on a pocket of Wea silt loam, a highly productive, well-drained neutral soil with a deep root zone that is typical of prairies. The site is underlain by glacial sands and gravels that provide good drainage for the underground food storage pits dug by the villagers.

The stockade bounding SunWatch Village enclosed an oval area approximately 125 m north-south and slightly less east-west. Inside, the village was arranged in a series of recognizable zones around a cleared public plaza (Fig. 3). The zones included an outer residential area marked by a single or sometimes double row of houses, each with a central hearth; a band of underground storage pits that were secondarily used for trash disposal; and the village cemetery. In the center of the plaza was a large pole made of eastern red cedar and flanked by four smaller poles that had been carefully spaced to form a parallel arrangement. Although the most obvious patterns at the village are the concentric arrangement of residential work, mortuary, and ceremonial areas, Heilman proposes that further village divisions were roughly marked by antonomastic elements from the central pole (Heilman and Hoefler 1980). The solstice sunrise lines divide the extant village into three radial sectors: two residential areas, one to the north and one to the south, and a public/ceremonial area to the west. A fourth sector to the east has been destroyed by road building.

The western sector is marked as the ceremonial and social center of the village by the large size and unusual content of the structures, the number and spacing of high-status burials, and by the number of exotic (non-local) and unusual goods recovered from the western trash pits. A great deal of secondary lithic reduction (the final stages of tool or arrowhead making) took place in and around one of the west side structures (Roberts 1984).

Other social divisions within the village are evident. Household burial plots can be delineated based on the distribution of congenital skeletal anomalies and pathology (Robbins 1976), and there is evidence of ceramic differentiation and their disposal point to possible stratified residential pattern (Heilman 1980).

Due to its short period of use before abandonment, SunWatch village essentially constitutes an archaological snapshot in time. Even before the site was nominated to the National Register of Historic Places, "Charcoal, Isotopes, and Shell Horse"

James M. Heilman (Curator of Anthropology) continued to reconstruct the village and opened it to the public (Fig. 2). My imagination was kindled with the possibilities of creating, as accurately as possible, the type of garden that would have been grown by the original inhabitants of the village. I wanted to breed plants that looked the same as those from 500 years ago. In a high school student named Anthony Comard enthusiastically agreed to plant the gardens I would design. We are still growing and perfecting the garden.

**Breeding the Plants**

The breeding program has been centered around corn. In 1978, we grew commercially available varieties, but by 1979, I had obtained Northern Flint corn from corn breeders and Indian contacts (see box on domesticates). In the initial years of our garden, we grew out and hand pollinated a number of types of Northern Flint, along with a few other races of corn (Fig. 5). The purpose was to make metric comparisons of cobs and kernels between the modern types and the archaological Fort Ancient corn. It was also to find which types are best suited to growing conditions in the Miami Valley. It was necessary to keep the separate types pure, or to make deliberate crosses. In the first year, a local garden club made possible the purchase of a small freezer to use for a permanent seed bank. Seed from the garden is dried, sealed in glass jars, and frozen to retain optimum long-term viability.

The goal is to breed selectively for those morphological and kernel characteristics that best closely mimic the archaological specimens. In actuality, most of our efforts have worked toward increasing our seed supply. Good intentions exceed available time for measuring, then harvesting and re-measuring the modern crops. Nevertheless, some comparative data have accumulated. Luckily, the morphologically distinct Fort Ancient corn undoubtedly became the morphologically distinct race, Northern Flint. No matter what type of Northern Flint we grow, we at least have the correct ancestral race.

The squash we grow is a thick-shelled variety developed by John White (Illinois) to replicate early Mandan-type strains. Like the early squash found archaeologically, it can be hollowed out and used as a container. Fort Ancient may mark the period when thinner-skinned "summer" squashes first became common crops, based on the negative evidence that few squash rinds are recovered from Fort Ancient sites. The drop in chamber squash rinds at Fort Ancient sites may not as reasonably be related to the methods of preparation, including the use or not of fire. At Middle and Late Woodland sites, rinds often are ubiquitous and abundant. Historic accounts describe a wide variety of squash forms, and comparable variety probably was present among the Fort Ancient squashes.

The beans we have grown, while replicating the length to width ratio of the Fort Ancient beans, have not been as small as the archaological beans. Although we have not deliberately bred our sunflowers, we have selected for multi-headed plants with achenes of a dark purple-black color. This color first appeared as a sport in the 1979 crop; the polycyclic trait may be attributable to natural outcrossing with local wild populations.

**Re-creating a Garden**

No actual Fort Ancient garden plot has ever been identified or excavated, so the design or layout of the fields is unknown. The ubiquity of weed seeds such as sunflower, purslane, and nightshade at Fort Ancient sites leads to speculation that gardeners selectively allowed certain weeds to grow along with the deliberate crops. An abundance of freshwater mussels that had been hatched and used as hoes
constitute indirect evidence for gardening (Fig. 10).

The gardening practices we follow are taken from historic accounts and descriptions of other Native American fields and gardening. There are a number of excellent descriptions dating from as early as the 16th century, and they all provide somewhat similar accounts. For example, Captain John Smith described native farming practices of 1607-1608:

The greatest labour they take, is in planting their corn, for the Country naturally is overrun with wood. To prepare the ground they bruise the barks of the trees near the root, then do they scourage the roots with fire that they grow no more. The next year with a crooked piece of wood they beat up the weeds by the roots, and in that mould they plant their Corn. Their manner is this. They make a hole in the earth with a stick, and into it they put four or six grains of wheat (corn) and two of beans. These holes they make four to five one from another. Their women and children do continually keep it with weeding, and when it is grown middle high, they till it about like a hop-yard. (Arber and Bradley 1910:357-358)

Two of the most detailed accounts are from the early 20th century: one by Arthur Parker (1910) on the Iroquois, and one recorded by Gilbert Wilson (1917) from the Hiwassee Iroquois.

In strict archaeological usage, these are far-fetched analogies to be making: one would prefer an historic account on the Fort Ancient Indians, but there are none. Only recently have the northern Kentucky Fort Ancient sites been definitely linked with the historic Shawnee, and we have no account of Shawnee gardening in this area. Because all of the historic accounts from eastern North America describe similar horticultural practices, we simply chose the most detailed and delightful account to use as our model for the SunWatch Village replicated garden.

We plant our garden plots in the pattern described by Buffalobirdwoman for the Hiwassee Iroquois (Wilson 1917). All of the corn, beans, squash, gourds, and sunflowers are grown in hills in a square to recorn/bean plots, and men tended the tobacco plots. We have no such detailed information for the Fort Ancient Indians.

We are learning that scheduling can be important in the success of a crop. Sunflower is planted in early May. We begin to plant corn the second week in May; some of the varieties we breed do best when planted early (the northeastern Northern Flints), whereas others need the warmer soil temperatures of the first week in June (the plains Northern Flints). Following the Hiwassee Iroquois schedule, we plant beans the second week in June (they require a warm soil for successful germination). Pre-moistened squash and gourd seeds are planted in late May to early June. The tobacco can be planted outdoors in early May. Our cheno- pod, which is wild rather than domesticated, germinates best if it is allowed to seed naturally in the fall.

The likelihood of corn crop success is related to the different kernel types within the Northern Flints: the Flint corn will almost always produce a good crop under the present growing conditions, but the Four corn crop may be drastically reduced by smut during the growing season and mold at the time of harvest. Smut is now endemic to the Ohio Valley. Slight shifts in the timing rather than the amount of rainfall may mean the difference between a good and a bad crop. Late summer/early autumn rainfall, such as we often have now, may result in the failure of the Four corn crop. Given the historic preference for the ease of propagation and taste of Four corn, the SunWatch villagers probably grew both Four and Flint corn, hoping for a crop from the Four, but depending on a crop from the Flint. So far, we have not identified whether the charred archeological kernels are Four or Flint, but we may be able to do so with the help of the scanning electron microscope.

Reaping the Harvest

One of the joys in growing an Indian garden has been experimenting with historic Indian recipes. Buffalobirdwoman used white flint corn in the following recipe for moyi-nakpaa:

I put water in a pot, and in this I dropped a section of a string of dried squash, with some beans. Dried squash was always strung on long grass string, and having...
Evidence for Domesticates

The direct evidence for domesticates at SunWatch and the other Fort Ancient sites is in the form of charred plant remains. Uncharred remains rarely survive at an open site that has been exposed to rain, frost, and other destructive processes. Charcoal is relatively inert and will preserve well so long as it is not mechanically abraded.

Plant remains that have been preserved through charring can retain their shape and distinctive cell structures, although there may be some distortion. Species and sometimes even races or varieties may be identifiable. Few experiments have been published on measuring the effects of charring different plant parts, but corn cobs are known to shrink, corn kernels may expand, and beans may either shrink or expand. These distortions must be taken into account when trying to reconstruct the actual appearance of the original specimens.

The domesticates recovered at SunWatch Village include corn (Zea mays), beans (Phaseolus vulgaris), squash (Cucurbita pepo), sunflower (Helianthus annuus), chenopod (Chenopodium sp.), and tobacco (Nicotiana sp.). Bottle gourd (Lagenaria siceraria), another domesticate, has been recovered from other Fort Ancient sites. Maygrass (Phalaris caroliniana), erect knotweed (Polygonum erectum), and marsh elder (Iva annua), which were cultivated by the Late Woodland inhabitants of the central Ohio valley, appear to have been dropped from the repertoire of the Fort Ancient farmers.

Corn
With the help of a number of observations and measurements, even individual corn kernels or fragments of cobs may be identified to race. Although no one kernel or cob character can consistently distinguish one race from another, some—such as cob row number and shape—may be highly diagnostic. Nearly forty years ago, Nickerson undertook a study to determine which cob characters best differentiate one race of corn from another (1955). Luckily, many of those characters are observable on fragmented, charred archaeological specimens.

The corn from Fort Ancient sites is quite homogeneous and appears morphologically similar to a distinctive historic eastern North American land race called Northern Flint. Historic and modern Northern Flint corn encompasses both Flint and Fleur kernels, as well as a variety of kernel colors. Although few farmers continue to grow Northern Flint today, it remains a major source of germ plasm for the commercially important midwestern dent corns.

Measurements taken on 326 cobs coupled with observations on 1,342 cobs from 18 Fort Ancient sites allow the reconstruction of a typical Fort Ancient ear of corn (Fig. 7). Like its descendant, Northern Flint, the Fort Ancient corn population typically contained 83 to 90 percent 8-row cobs, 10 to 15 percent 10-row cobs, and 5 percent or less 12-row cobs. After correcting for shrinkage due to carbonization, the cobs measure 8.9 to 12.6 cm in length and from 1.3 to 1.6 cm in diameter at the midpoint of the cob. The cob tapers toward the tip from a large, sturdy shank and slightly enlarged butt, and the kernels accordingly are graded in size from larger to smaller. Overall cupule width averages 11.0 mm and kernel thickness averages 4.6 mm, forming a shallow, broad, but fairly open cupule. The kernels of Fort Ancient corn are longer and broader in width than in depth. For the most part, they are flour and flint, although a few probable popcorn cobs have been recovered. The 8-row kernels average 11.4 mm in width and 8.6 mm in depth.

Beans
Modern varieties of beans can be distinguished by two characters, seed shape and size, that are present in archaeological specimens and by one character, seed color, that is no longer observable after charring. All of the Fort Ancient beans belong to the genus and species Phaseolus vulgaris, which has hundreds of historic and modern varieties (for example, kidney, navy, great northern, pinto). Without the character of color, it is so far not possible to define the exact variety of the archaeological specimens. During carbonization, even though the bean may either expand or shrink, the shape of the bean remains recognizable, and the ratio of length to width remains virtually the same.

The majority of Fort Ancient beans are entire (oblong) to reniform (kidney-shaped) in form, with rounded to somewhat pointed (sometimes truncate) ends, a flat rather than a plump cross section, and a length-to-width ratio of 1.7 to 1.9. These squash are very similar to a number of named historic and modern varieties, such as Genuine Cornfield and Arikara Yellow, but the size (after accounting for charring) is smaller than the modern varieties. There is some evidence for a second variety, one that is plumper and more rounded, with a length-to-width ratio of 1.2 to 1.4.

Squash
Squash remains, which are common at preceding Late Woodland sites in the same area, are found infrequently at Fort Ancient sites. Only charred rind fragments have been recovered from SunWatch Village (Fig. 9), but both rinds and occasional seeds have been recovered from other Fort Ancient sites. All of the squash belong to the polymorphic genus and species Cucurbita pepo, which today includes summer squashes, true pumpkins, and ornamental gourds (for example, acorn squash, Connecticut Field pumpkin, scallops, zucchini, and crooknecks). It is not possible to define the archaeozoological varieties, although the preserved rind fragments tend to be from the thick—rather than thin-skinned varieties. The measured charred rind fragments from SunWatch Village are 1.9 and 2.2 mm in thickness. Likewise, the gourd fragments that have been recovered are not complete enough to reconstruct the prevalent or preferred shapes grown by the Fort Ancient Indians.

Sunflower
All of the sunflower achenes recovered from Fort Ancient sites are fully domesticated, based on a comparison of the size index (length/width). Approximately 18,472 sunflower kernels and achenes, charred but still visibly striped, were recovered from the Cramer site. So far, only one achene has been identified from SunWatch Village.

Tobacco
Tobacco has been recovered from four Fort Ancient sites. Although comparative morphological studies are yet incomplete, the species is thought to be Nicotiana rustica, the species first encountered historically in the eastern United States. The tiny seeds, which are the size of a period at the end of a sentence, can only be recovered through flotation. This is a technique in which dirt from an archaeological context is dumped into a screen-bottomed container immersed in a body of liquid (usually water). Objects that are small and light, such as seeds, float to the surface and can be separated without harm from the dirt matrix.

Chenopods (Goosefoot)
Based on fruit morphology, both wild and domesticated types of chenopods have been recovered by flotation from SunWatch Village. Chenopod, perhaps better known as goosefoot, is no longer cultivated in North America. The closest probable living relative to this archaeological material is Chenopodium berlandieri ssp. nuttallianum, of which three domesticated varieties are still grown today in Mexico for the nutritious greens (haciazoite and quiche) and the grain-like fruits (chia). The wild chenopod fruit has a thick coat with a biconvex shape, whereas domesticated chenopod fruit has truncate margins and a very thin coat (Fig. ba).

Scanning electron microscope picture of charred wild (a) and domesticated (b) type chenopod fruits (from SunWatch Village). The thick coat of the wild type is visible at the bottom left, below the extruded endosperm. The thin coat of the domesticated type can be seen in the upper center of the fruit. Note the biconvex (wild) versus the truncate (domesticated) margin shapes.

500 µ
Scanning electron microscope picture of charred squash rind from SunWatch Village. The distinctive cell structure can identify it to genus Cucurbita, but not to species; seeds and peduncles (stalks) can complete the identification.
from one of these strings, cut off a piece I tied the ends together, making a wreath, or ring, four or five inches in diameter. It was this ring of dried squash slices that I dropped into the pot. When well boiled, I lifted the squash slices out by the string and dropped them into a wooden bowl, where I mashed them and chopped them fine with a horn spoon. The mashed squash I dropped back into the kettle again, with the corn; the now empty string I threw away. Meanwhile corn had been parboiled, and some buffalo fats had been held over the coals on a stick, to roast. The parboiled corn and roast fats I pounded together in the corn mortar; and the pounded mass I stirred into the kettle. The mess was now ready to be eaten. (Wilson 1917:90)

Recipes can be based on fresh foods, dried foods, or a combination of the two. For example, green corn could be boiled or roasted; it could be shaved and boiled to make mash, shellled, pounded, and baked to make bread, or half-boiled on the cob, dried, shellied, and dried for storage.

What was the mix of these plant foods in the Fort Ancient diet? The charred botanical remains do not directly reflect the diet, since not all plant parts char and preserve equally well, nor are they all discarded in the village or exposed to fire. Analysis of the trash from pits filled in the summer versus the winter months reveals no significant seasonal differences in the types of plant food remains that were discarded (Wagner 1987). Likewise, Fort Ancient skeletal populations do not reflect episodic fluctuations in health stress.

On the other hand, the skeletal remains do reflect the detrimental effects of a dietary dependence on corn. The Fort Ancient populations have high rates of dental caries, as well as other bone pathologies. Heavy carbon isotope analysis of the bone collagen can roughly indicate the amount of corn in the diet. This is because corn, like a number of other plants that originated in hot, dry areas, carries a particular isotopic signature that is passed on to the species of river mussels that were favored for use by the Fort Ancient Indians; other, more pollution-tolerant species now dominate the rivers. These concerns emphasize the fact that present conditions are not the same, and thus can provide only rough analogs for interpreting past behaviors.

There is real value to both the participating archaeologist and the observing public in continuing to replicate, as faithfully as possible, past gardens such as these. The archaeologist views such experimentation as a laboratory for more closely examining past behaviors. The public gains an opportunity to observe and experience certain aspects of past lifeways in a way that encourages imaginative understanding. Besides, it's fun!

Bibliography


Wagner, Call E. 1987 "Use of Plants by the Fort Ancient Indians." Ph.D. diss., Dept. of Anthropology, University of Illinois, Urbana-Champaign.

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