Fish Fertilizer: A Native North American Practice?

Documents and cultural analysis show that Indian cultivation did not include fish fertilizers.

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On 16 March 1621, a New England native named Squanto strode into the new settlement at Plymouth greeting the pilgrims with: "Welcome Englishmen" (*1*, p. 51; *2*). According to Pilgrim Braddock, sometime that spring, Squanto "directed them how to set corn, where to take fish, and to procure other commodities" (*3*), an act which assured him a prominent place in American history.

The Plymouth farmers promptly accepted Squanto's advice, for a letter written from there the following winter states: "We set last spring some twenty acres of Indian corn, and sowed some six acres of barley and pease, and according to the manner of the Indians, we manured our ground with herrings, or rather shad, which we have in great abundance" (*1*, p. 81).

The phrase, "manner of the Indians," seems to be an extension of Squanto's particular knowledge of fish fertilizer to all Indians in general. According to available records, this first generalization was written before any Pilgrim had actually witnessed how Indians in general planted their corn. Indeed, by the spring of 1621, the cultivation practices of Squanto's tribe were no longer observable because of a recent plague, and Squanto had become "the only native of Patuxet," that is, New Plymouth (*1*, pp. 55, 61). When planting procedures were actually witnessed in the following years, many observers noted somewhat to their surprise that Indians employed neither fish nor any other type fertilizer.

Nevertheless, the original and, as I hope to demonstrate, unfounded assumption that the use of fish fertilizer was a "manner of the Indians" in New England has been accepted for centuries. In 1916, Wissler included the practice of fertilizing, with fish where available, as a trait belonging to the aboriginal maize culture complex "everywhere in the Mississippi Valley and eastward" (*4*, p. 657). By 1917, Wissler claimed that the method of "placing a fish in the maize hill" was "widely distributed in both continents" (*5*, p. 23). He thus linked Squanto's advice at Plymouth to coastal Peru, the only other confirmed location in the New World where fish (actually fish heads) were utilized as fertilizer in prehistoric times (*6*).

The idea that many North American Indians knew about or used fish fertilizers has become entrenched in anthropological and botanical literature (*7*). The inference appears repeatedly in textbooks and popular publications, even annexed to corn recipes (*8*), and is annually reinforced when countless schoolchildren learn of Squanto's contribution in pageants of the Pilgrims' first Thanksgiving.

The first challenge to the belief that Indians used fish fertilizers appeared in Flannery's 1939 research on coastal Algonquin culture traits. Unable to find sources confirming the practice anywhere along the eastern seaboard, she concluded, "The aboriginality of the trait is questionable" (*9*, p. 10).

Wissler's fish fertilizer statement was next challenged in 1957 by Rostlund who discussed problems involving availability of fish species, vagaries in the original citations, and the uniqueness of the practice. Rostlund concluded that use of fish fertilizer was not a "common and widespread practice in any part of native North America" (*10*, p. 228).

I have collected new evidence from the perspective of an ethnohistorian and anthropologist. This evidence substantiates Flannery's and Rostlund's earlier conclusions and further suggests that Squanto learned about fish fertilizers in European settlements, not from Indians for whom the practice was not culturally adaptive.

Squanto's Experiences with Europeans

Since Squanto's actions remain the singular basis for the claim that use of fish fertilizers was a native North American practice, let us examine the possible sources of Squanto's agricultural knowledge. His rather remarkable history, often uncited, indicates that he had ample opportunity to learn the "manner" of Europeans as well as of Indians.

In 1614, Captain Thomas Hunt kidnapped Squanto and sold him into slavery at Málaga, Spain (*3, 11*). This may have been Squanto's second kidnapping experience because Gorges claimed (in 1658) that Captain George Weymouth had kidnapped Squanto before, in 1605 from Maine (*12*). However, Squanto's name, or any known variation thereof (Tisquantum, Tasquantum) does not appear on the list of kidnapped Indians compiled by Rosier who sailed with Weymouth (*13*, p. 394). Since Gorges' account was written 53 years after the event, some have questioned its accuracy (*14*). Similarly, it may be questioned whether the native "Tantum" brought from England to Cape Cod in 1615 by Captain John Smith (*3*) was this same Indian, Squanto.

Somewhat clearer documentation indicates that Squanto was smuggled from Málaga by a captain of a ship belonging to the Guy Colony in Newfoundland; he was brought to "Cornhill," in London, where he resided for 2 years with John Slany, treasurer of the Newfoundland Company (*1*, p. 55; *11*). Squanto was next taken to a Newfoundland settlement in "The Cupids" (*11*, p. 104) and there served "captain Mason governour there for the undertakers of the plantation" (*15*). He later acted as pilot and guide for Captain Thomas Dermer who eventually brought him to Cape Cod. Squanto died in 1622 (*3*).

Thus, in the years immediately preceding his appearance at Plymouth, Squanto had not resided in Indian settlements, but in those of Europeans, in both the Old and New Worlds. In

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European settlements, the use of fertilizers was a feature of farming technology since the Roman expansion (*16*) if not earlier (*17*, p. 68). The particular use of shellfish debris was famous in France since the medieval period, and the crops in the coastal zone where this type of fertilizer was employed were so productive that the area was traditionally known as the "gold coast" (*18*). Fish fertilizer was cited in an English publication in 1620 (*10*), that is, before Squanto's Plymouth appearance. Therefore, one cannot eliminate the possibility that settlers having prior farming experience already knew about the value of fish as fertilizer before the spring of 1621.

Similarly, various fertilizers may have been employed in the New World before 1621 by Englishmen known to have planted seeds: in Newfoundland in 1583 (*19*); in the Cape Cod area in 1602 (*20*) and 1603 (*21*); and in Maine in 1605 (*13*, p. 365), 1607 (*22*), and 1614 (*23*). (Two possible contacts of Squanto, Weymouth and later Smith, gardened during their visits to Maine in 1605 and 1614.)

In the 1606 to 1607 French colony of Maine and Nova Scotia, fertilizer usage was specified: the ground was "improved" with "hogs' dung, or the sweepings of the kitchen, or the shells of fish" (*24*). English colonists of Virginia used "manures" in 1611 and 1614 (*25*).

After 1610, agriculture was practiced and domesticated animals were kept in the John Guy and "Bristol's Hope" colonies, both located along an inlet named "The Cupids" on Conception Bay, Newfoundland (*11*, p. 98; *26*). In 1615, Guy was replaced by Captain John Mason (*27*), Squanto's employer (*15*). In his 1620 book entitled *A Briefe Discourse of the New-found-land*, Mason noted that "June hath Capline a fish much resembling smeltes in forme and eating and such aboundance dry on shoare as to lade cartes." He wrote glowing accounts of the local harvests and attributed the success to use of locally abundant fish as manure: "For one acre thereof be inclosed with the Creatures therein. . . would exceed one thousand acres of the best Pasture with the stock thereon which we have in England" (*28*, p. 151).

Since Squanto was present at this same settlement during the period when Mason's descriptions were written, he probably was exposed to these same scenes of surplus fish converted to manure. Given this and earlier opportunities to learn the value of fertilizer, particularly fish, I suggest that Squanto acquired his agricultural knowledge from European examples. Then, on his 1621 visit to Plymouth, he merely passed along practical advice which he knew to be successful from his most recent experiences with Europeans, not Indians.

Indian Planting Methods

The possibility that Squanto learned about fish fertilizers from Indian cultivators is reduced if not altogether eliminated if one examines the available records for Indian methods of planting corn. I will consider only the eastern coast of North America because it was only in this zone that sufficient numbers of fish could be obtained during the critical period of spring planting; anadromous fish ascending rivers to spawn and other coastal marine species such as "shad, alewife, and other members of the herring family" (*10*, p. 223) were especially abundant and easily taken. Corn was not grown by Indians along the western coast of North America (*5*, p. 20).

Along the south Atlantic Coast, from Florida through Virginia, Europeans described Indian planting techniques in the 16th and early 17th centuries; none cited the use of fertilizers (*10*, p. 224; *21*, pp. 435–460; *29*). Where numbers of trapped fish were observed, the use of fertilizer was emphatically denied: "The ground they never fatten with mucke, dounge, or any other thing . . . as we do in England" (*29*, p. 341).

Further north, along the mid-Atlantic coast, the Dutch of New Netherland (now, areas of New Jersey, New York, and Connecticut) also described cultivation practices of the surrounding natives. Again, the use of fertilizers was not mentioned (*30*), even in descriptions of those areas where Indians took much fish each spring (*31*). Van der Donck claimed in 1653, after residing near Indians of the upper Hudson River Valley and coastal New York for 8 years, that he had "never seen land manured" by Indians and that "of manuring . . . they know nothing" (*32*, pp. 30–31, 96).

From New Netherland north to the northernmost limit of Indian cultivation in Maine (*33*), available citations identify only the English of New England as the users of fish fertilizer (*34, 35*). Bradford, one of the original Plymouth settlers, wrote: ". . . except they got fish and set with it in these old grounds it would come to nothing" (*36*, p. 85). In 1634, Wood noted that it was the English who "manured their land with fish" and that if there was no "alewife-river" the English settlement suffered an "inconvenience" (*37*, pp. 12 and 34). DeRasieres, the Dutch Secretary at New Netherland, visited Plymouth in 1627 and detailed the English farmers' use of fish for fertilizer (*38*); his comments imply that he found the procedure unusual and noteworthy, that is, he had not seen nor heard of it before, among Dutch or Indian cultivators.

That Indians of New England did not farm as the settlers did earned them harsh criticisms: Indians grew "corne without fish" (*39*) because, according to Wood, they were "too lazie to catch fish" (*37*, p. 12); in Mourt's *Relation*, the early journal from Plymouth, an anonymous author wrote, "They are not industrious, neither have art, science, skill or faculty to use either the land or the commodities of it, but all spoils, rots, and is marred for want of manuring" (*1*, pp. 91–92).

A consistent, uniform cultural pattern emerges from the available documentary evidence: use of fish fertilizer was not a "manner of the Indians" in North America at large, or even in New England, Squanto's provenience. Indeed, the fact that Indians failed to employ fertilizers even after years of exposure to European farming technology suggests a kind of cultural "resistance" to the practice. Let us therefore examine the anthropological implications for planting corn with fish.

Indian Means of Maintaining Corn Productivity

The principal form of Indian corn grown "throughout the eastern United States" in the prehistoric and early historic periods was the Eastern Complex, also known as the Northern Flint, race (*Zea mays* var.) (*40, 41*). Like its modern hybrid descendants, the productivity of Eastern Complex corn depended on a set of growing conditions that involved temperature, sunlight hours, length of growing season, moisture, soil composition, and nutrients (*41*, p. 149; *42*, pp. 547–552). The availability of particular nutrients, for example, phosphorus, nitrogen, calcium, and lime (a neutralizer of acid soils), directly affected its rate of maturation, plant size, and hence its productivity (*42*, pp. 55–59; *43*).

Unless maize is cultivated in exceptional soil zones enriched with nutrients by some natural method (as along a floodplain), used soils are annually depleted of nutrients and productivity drops. The problem of diminishing yields is most commonly resolved by either of two solutions: (i) planting is moved to new, more fertile soils, or (ii) lost nutrients are restored by means of fertilizers. The first solution allows either a move to new, still naturally fertile fields, or a return to older abandoned or "fallowed" fields which have regained some fertility by "resting." Shifting cultivation was characteristic of earlier "nomadic" agriculturalists over much of the world (*17*) and was apparently the practice of Indians cultivating Eastern Complex throughout the Northeast during the prehistoric and early historic periods.

In interior regions, groups known as successful producers of corn (the Huron of southern Canada and Iroquois of western New York) moved their settlements every 8 to 12 years, in part because of soil depletion (*44*). Accordingly, northeastern archeologists recognize the prevalence of shifting cultivation and the importance of soil depletion when interpreting sites occupied by Indian cultivators of corn; the duration of the site's occupation may have largely depended on the fertility of natural soils (*45*, p. 4).

Shifting cultivation was also practiced by Algonquian cultivators located along the Atlantic Coast in the Northeast. In 1605, Champlain noted that Indians on Cape Cod left fields uncultivated in order to "let them lie fallow" (*34*, pp. 351–352). In the Plymouth area, the soil was "sandy, acid, easily leached, . . . ill-suited to agriculture" (*46*, p. 54). That native cultivators shifted fields in this area to improve corn productivity is suggested in the observations of Pilgrim "explorers" who clearly distinguished formerly planted "corn ground" from recent fields bearing "new stubble" (*1*, pp. 21, 33–34, 40; *36*, p. 65). Winthrop defined fallowing in his 1636 comment: "they have every one 2 feilds [sic], which after the first 2 yeares they lett one feild rest each yeare, & that kepes their ground continually in hart" (*39*). In 1643, Roger Williams recorded two terms for "planting fields" among the Narragansett Indians, one meaning "worne out" field and the other, "new ground" (*47*, p. 119); the distinction between the terms implies the practice of shifting cultivation. When Van der Donck recommended a site for corn, New Netherland Indians responded: "It is but twenty years since we planted corn there, and now it is woods again" (*32*, p. 20).

Implications of a Decision to Use Fertilizer

The second solution for crops diminishing because of soil depletion is the restoration of essential nutrients by applying fertilizers such as ashes, manures, shells, fish, and garbage. The use of fertilizers is an advanced trait not only because it makes "possible" the "occupation of permanent villages and fields" (*17*) but because it is a complex technological concept, that is, it requires recognition of the cause and effect relationship between soil improvement and later productivity.

Thus, a decision to use a particular fertilizer is necessarily preceded by recognition of its value. Among the natives of North America, observation of the value of animal manures for soil improvement was precluded by their lack of any penned, domesticated animals. Fish, an excellent fertilizer for corn, was available in sufficient quantities during the spring planting period in one geographic zone (*10*) but, according to extant documentation, natives did not employ fertilizers of any kind in this area. Ashes appear to be the only agent that Indians would have been likely to use as a fertilizer because it was naturally produced wherever they cleared fields by burning.

Yet it is not clear from documentary sources that the specific value of ash as a fertilizer was recognized or intended because other reasons for burning fields were usually given. For example, Indians of New Netherland recognized that their annual "bush burning" brought better grasses, but they, like some others in New England, confined their burning to wild areas where they hoped to attract game, that is, improve hunting (*32*, pp. 20–21; *37*, p. 15); they did not transfer the concept of ash-improved growth to their planting fields. Similarly, Algonquians of Virginia burned "weedes, grasse, & old stubbes of corne stalkes." Because they neither dispersed the ash "heapes" nor "set their corn where the ashes lie," Hariot concluded that these natives did not know how to use ashes "to better the grounde" (*29*). Most probably, burning was undertaken to simply clear fields, and the ashes produced and their beneficial effects on the soil were incidental. In short, the opportunity to discover the cause-and-effect relationship between application of various fertilizers and better harvests was somehow limited, was apparently not recognized, or was quite possibly rejected.

The nature of the task involved in the use of fish as a fertilizer suggests another reason why this practice was not adopted by Indian cultivators. Plymouth farmers are estimated to have prepared 360 hills per acre (0.405 hectare) of Indian corn (*46*, p. 9). Observers saw two, three (*10*), or four (*38*) whole fish applied to each hill. Thus, a single acre required between 720 and 1440 fish. That first 20 acres (8.10 hectares) of Indian corn planted at Plymouth (*1*, p. 81) truly required the "great abundance" cited: 14,400 to 18,800 fish. Some New England colonists were said to fertilize 100 acres with 1000 to 3000 fish per acre (*48*) or between 100,000 and 300,000 fish. If each fish weighed as little as 1 pound (0.4536 kilogram), then tons as well as numbers of fish were involved in the procedure.

From this aspect of the quantity of fish used for fertilization, it is not difficult to understand why Indians would have resisted the practice of using fish to promote their crops. This is particularly so when it is recalled that allocation of huge fish supplies to the soil would necessarily have taken place during the Indians' hungriest season, the traditionally lean spring (*32*, p. 76; *33*). Records indicate that northeastern natives took the more predictable course of action: they feasted on spring supplies of fish protein and converted surplus amounts to future supplies by smoking or drying (*9*, p. 178; *32*, p. 76; *47*, p. 138; *49*, p. 150; *50*) and even bartered some for European trade goods (*51*).

The English were able to obtain "2 or 3000 [alewives] at a set" (*37*, p. 34) and up to "10,000 to 12,000 fish" at "one tide" (*38*). Such huge quantities obtained in a single day must have resulted in surpluses far beyond the amount of fish that could be immediately consumed or processed (salted) "against the winter" (*37*, p. 34). Such a surplus, perhaps grown spoiled, might then be used "for the ground" (*37*, p. 34) or even fed to the pigs (*46*, p. 48). That English farmers used fish as fertilizer only when or even because there was a surplus is suggested by both the Mason data from Newfoundland (*28*, p. 151) and the New England citation, "the plenty of fish which they have for little or nothing, is better to be used, than cast away" (*37*, p. 12).

If Indians were to resolve the problem of their harvests of corn declining because of poor local soils, it is unlikely that they would have decided to (or been able to) trap thousands (and tons) of fish beyond their immediate needs to reach that same point of surplus achieved by English settlers. It would have required far less planning and effort simply to shift their planting fields and to ignore the fish fertilizer "solution."

Other aspects of the use of fish as fertilizer are the technology and, at certain seasons, the greatly intensified labor requirements, elements more common to European settlements than to those of northeastern Indians. Plymouth farmers had traditional tools appropriate for the task: shovels, plows, harrows, hoes, dung forks, carts for hauling manures (*46*, pp. 33 and 36), and, later, working animals. In addition, heavy farm chores were undertaken by a labor force that was principally made up of males: fathers, sons, other relatives, even indentured servants (*52*).

In contrast, Indian cultivators had few tools to work with: wooden digging sticks, crude hoes (of stone, bone, antler, or shell), and simple carrying baskets (*9*, pp. 11–13, 53–54). The division of labor among northeastern Indians reflected the value system of societies still largely dependent upon wild foods for subsistence. Despite the genuine contribution of plant foods, hunting and fishing remained more prestigious subsistence activities and were male tasks. Cultivation was therefore the responsibility of females (*32, 49, 53*).

Women in European settlements gardened and performed some farm chores but they did not suffer the "slavish life" of Indian women who had to undertake all farm chores: "they carry all their burdens, set and dress their corn, gather it in, etc." (*54*). Roger Williams estimated that Indian women produced 24 to 60 bushels of corn annually for their families (*47*, p. 124); since these cultivators are thought to have achieved yields of 18 bushels (6.336 hectoliters) per acre (*46*, p. 9), between 1.3 and 3.3 acres must have been planted. If plots of this size were to be kept fertile by dressings of fish, an Indian woman would have needed to obtain, transport, and apply between 960 and 2400 fish. Moreover, one would have to suppose that, faced with several alternatives for maintaining corn productivity, an Indian woman preferred this burdensome series of chores to the far easier task of shifting her corn plots to other fertile, and available, areas.

Indian men may have recognized the improved productivity of European methods, yet they would not have easily changed their traditional roles and helped with the heavy fieldwork that fish fertilizer entailed. Planting was women's work affording no prestige and, as they realistically noted, the settlers' methods "require too much labor" (*32*, p. 96).

For the settler faced with the problem of poor soils and declining harvests, the reverse was the case: less labor was required to apply locally abundant manures to his field than to move his fields or settlement, or both, as the natives commonly did. Winslow implied this rationale in his comment, "Where men set with fish (as with us) it is easy so to do than to clear ground and set without some five or six years, and so begin anew" (*54*, p. 101).

In short, decisions to use fertilizers and to practice shifting cultivation can be evaluated as cultural strategies, that is, as specific programs to achieve desired levels of agricultural production. As strategies, they can only be understood within the social, political, economic, technological, and even ideological context of the whole culture system in which and for which they were designed.

Clearly, particular agricultural strategies depended upon the availability of critical resources, for example, open land, fertilizing material, labor, tools, other food sources, and so forth. The shifting of cultivation and the use of fertilizer are also settlement strategies. Therefore, concepts of property and community as well as ease in moving household goods and rebuilding dwellings were probably additional considerations.

Data from prehistoric and historic Iroquois suggest the kinds of culture system changes that made fertilizer usage more adaptive than shifting cultivation. The presence of traders and expanding colonial settlements completely transformed the Indians' culture system and agricultural strategy. Scarce cultivable land and availability of European agricultural technology and staple foods are thought to have brought about permanent settlements (*45*). Acceptance of western values, life on reservations, and replacement of hunting by farming as prestigious male tasks are associated with the adoption of "white agriculture" (*55*). Additional research is needed to discover whether similar processual changes may have taken place among Algonquian cultivators during the late historic period.

Although the culture system of northeastern Indians can never be completely known, documentary data for the early historic and presumably prehistoric period permit a partial reconstruction. From this, it appears that fish fertilizer was not a "manner of the Indians" because shifting cultivation was the more adaptive cultural strategy.

Conclusion

The belief that the use of fish fertilizers originated among North American Indians, and was communicated as such by Squanto to the Plymouth settlers, has achieved the status of folklore and is therefore difficult to challenge. However, examination of the documentary evidence of Squanto's history and of native cultivation practices, and a cultural analysis of the implications of the use of fish fertilizer, have produced complementary lines of evidence. This evidence indicates that widely held beliefs about the "manner of the Indians" should be revised: Squanto's advice at Plymouth is probably best viewed as an interesting example of culture contact, one in which a native "culture-bearer" conveyed a technological idea from one group of Europeans to another.

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NEWS AND COMMENT

Laser Fusion: An Energy Option, but Weapons Simulation Is First

Offi and on for almost 20 years now, the United States and the Soviet Union have professed interest in signing a comprehensive nuclear test ban treaty. But if the two superpowers do eventually come to terms on a comprehensive test ban, a remarkable and rapidly evolving new technology may, in important ways, help both sides circumvent it.

The new technology is laser fusion, a technique for creating miniature thermonuclear explosions by hitting pellets of hydrogen with converging laser pulses of enormous power. Over the past few years laser fusion has been widely hailed, both by the press and by its developers in the national laboratories, as a potential shortcut to one of the ultimate objectives of nuclear research—cheap electric power from thermonuclear fusion. Although there is no question about the sincerity of these hopes, it is not generally understood that the immediate practical objective of the government's $68 million laser fusion R & D program is to devise a laboratory technique for simulating nuclear weapons explosions. Indeed, there is a body of opinion—though generally not shared by the national laboratories—which holds that weapons simulation may be the only practical application for laser fusion in this century.

According to weapons authorities, laser fusion promises "orders of magnitude" improvement over present methods of simulation for two distinct but related purposes. First, bursts of radiation from large but controlled "microexplosions" triggered by laser could be extremely useful in testing the effects of weapons radiation on satellites, warheads, and other military hardware packed with delicate electronics.

Perhaps more important from the arms controller's point of view, weapons experts expect laser fusion to become an extraordinarily valuable experimental tool for studying basic "weapons physics" and, in conjunction with increasingly refined computer simulation codes, for developing new warhead designs.

Under any circumstances, laser fusion thus promises to save a great deal of time and money now spent in setting off bombs under the Nevada desert. Some scientists involved in the program say, in fact, that laser "target shooting" experiments in the past few months have already begun to benefit the weapons program by helping to refine the design codes. Thus, quite literally, laser fusion is emerging as a new means of bringing nuclear testing indoors—a prospect that seems all the more attractive in the context of a test ban.

"People go around town saying this is an energy program, but that's something that came along only after energy research got popular," Major General Edward B. Giller, the chief of national security in the Energy Research and