
Squanto's
Garden

Contents

An Introduction to Squanto's Garden

When the Pilgrims first came to America, they nearly starved because of insufficient food. It was with the help of a Native American they knew as Squanto that they learned to properly cultivate the land so that they could survive and flourish.

All of that might seem quite removed from your own gardening endeavors, however there is much to be learned from those historical lessons. What was the soil like then? How did the soil affect the food being grown? What techniques were used to enrich the soil? Why is it that the Pilgrims, being from a more technologically advanced society, needed the help of the Native Americans to survive?

Whether you are an experienced gardener, or just starting out, "Squanto's Garden" has plenty to teach you. The information in this book is designed to help any gardener learn about soil and how it affects the things that grow on it. One of the best aspects of this type of gardening is that you will learn to work with nature, rather than against it. You will learn to create a garden, or transform an existing one, using the same techniques that were used to bring about the first Thanksgiving. You will also learn important and little known information about that early period in American history, and the real truth about the Native American Squanto.

What this Book Will Cover

In this book, we are going to look at the history of agriculture in America from the arrival of the Pilgrims and how we can incorporate that knowledge into everyday gardening. The lessons from Squanto's time provide valuable keys to enriching the soil for healthier, tastier fruits and vegetables. This book is organized to take you straight

from the critical background material straight to how to use the information in your own garden.

In Chapter One, we will briefly look at the history surrounding the Pilgrim's arrival in North America and their interactions with the Native Americans. We will also look at the history of the man known as Squanto.

Chapter Two will look at the soil in Squanto's time. You will see how soil affects what is being grown on it and why the Pilgrims struggled so much before adapting to the Native Americans' techniques.

In Chapter Three, we start to bring our new understanding of soil up to the present day. We will look at the condition of soil in America and what it means to the food we grow on it. You will also understand the factors that have contributed to the current soil condition.

Once you have all of this information, you will be ready for Chapter Four, where we break down exactly how you can incorporate Squanto's teachings into your garden today. Specifically, you will learn about planning for enriching the soil of your own garden. You will also learn how to plant and maintain your garden by Squanto's standards. We will also discuss how you can use your fruits and vegetables.

In the conclusion, we will briefly discuss Squanto's legacy and the current environmental concerns surrounding soil depletion.

The appendix contains a valuable list of resources, both print and Internet, so that you can learn more about Squanto and soil-enriching gardening techniques.

Chapter One

Squanto and the Pilgrims:

A Historical Overview

Before we begin looking at what Squanto taught the Pilgrims, it is important to have some background into this history and the circumstances surrounding the arrival of the Pilgrims in the New World and their struggle for survival. We will also look at the real story behind the first Thanksgiving.

Squanto, as a historical figure, is commonly included in lessons in elementary schools. The general tale taught is that Squanto, a friendly Indian who spoke English, acted as an interpreter and guide to the Pilgrims. After their first winter, over half of the colony had died, largely because of lack of food. Squanto taught the Pilgrims to fertilize corn by planting each seed with a dead fish, based on an old Native American technique. The plentiful harvest that autumn was celebrated in a peaceful gathering of Pilgrims and Native Americans that would become known as the first Thanksgiving.

While for the most part the above story is true, it does give a very misleading impression. To look at the whole story of what happened, we need to look back further than the Pilgrims, to Squanto's first encounter with the English.

Squanto's History

Before the Pilgrims

Squanto is actually an abbreviation used by the English, who were unable to pronounce the name Tisquantum. Tisquantum, meaning "Rage of the Manitou," was likely not Squanto's real name either, but rather, one adopted for dealing with the English.

Squanto came from the Wampanoag tribe and was a member of the Patuxet band. The Wampanoag and their associated bands were the dominant Native American tribe in the area that the English first explored and that they would initially colonize. The first possible record of Squanto appears in writings from 1605. The memoirs of Ferdinando Gorges tell that Squanto was taken from his home as a captive and brought to England by George Weymouth. Historians have been unable to verify the accuracy of these memoirs, but if they are true, than it means that Squanto worked in England for nine years before returning home on Captain John Smith's 1613 voyage.

This is where history becomes a bit more certain, because of the verified written records available. Either shortly after returning or for the first time, Squanto was taken captive in 1614 by an English explorer, Thomas Hunt. He was one of a group of 20 Patuxet kidnapped brought to Spain by Hunt who sold them into slavery once there. A local group of Spanish friars who were opposed to slavery rescued Squanto and a number of the other captives.

Squanto traveled to England and found employment with John Slanery, a man who was interested in the exploration of the "New World." He sent Squanto on an expedition to Newfoundland in 1617. There, Squanto became acquainted with explorer Thomas Dermer, with whom he traveled back to England. Some historians have suggested that his relationship with Dermer and Slanery might possibly have been as an indentured servant working to earn passage home. It is known that Squanto traveled back to his homeland with Dermer in 1619.

He returned to the Putaxet village of his birth to find it was abandoned. An epidemic had swept through the area while he was away, completely decimating his band and striking all of the Native American populations in the Massachusetts Bay area. Whether this epidemic was caused by diseases that Europeans had brought with them, such as smallpox, is not known.

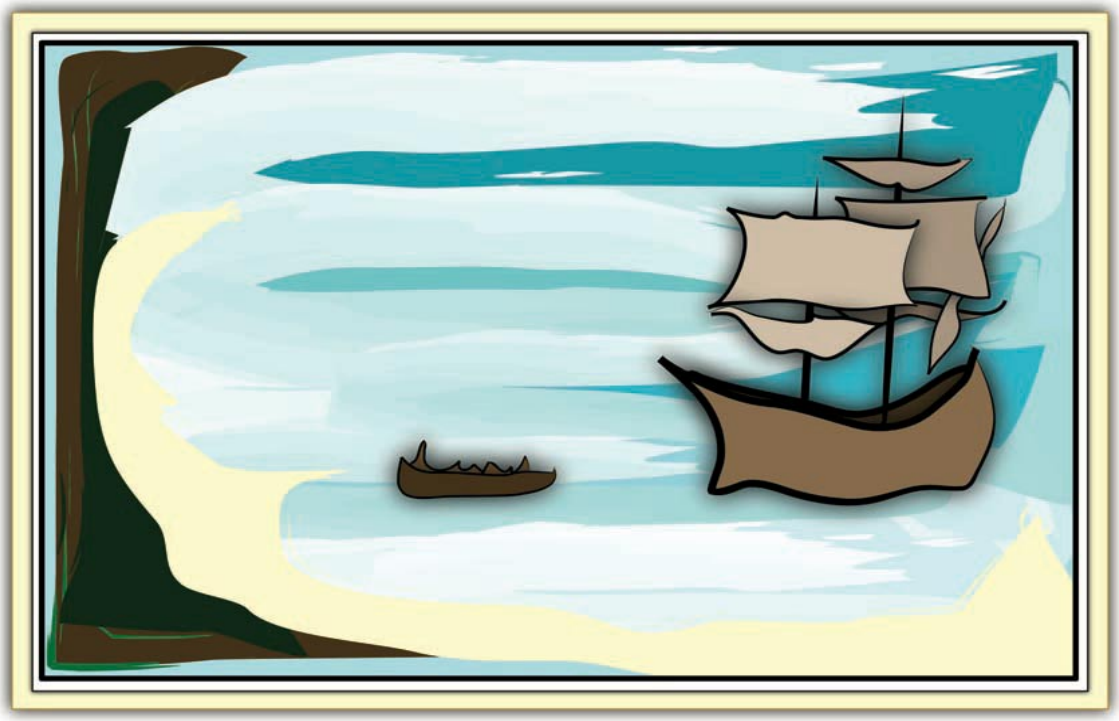
Squanto left Dermer to look for survivors from his village, however, he returned to help Dermer because of hostilities the expedition was encountering with local Native American populations. In a violent encounter with a band of Pokanoket Wampanoag, Dermer was mortally wounded and Squanto was taken prisoner.

The Pilgrims & New Plymouth

During the period that the Squanto was a captive of the Wampanoag, 102 settlers from England set sail aboard The Mayflower. These settlers were made up of religious separatists who had fled to Holland, and the group teamed up with English investors from the Virginia Company of London who wanted to see a colony established in America.

After a false start when some of the settlers almost began their voyage on ship found to be untrustworthy, they set off in The Mayflower on September 16, 1620.

The journey began smoothly, but became difficult due to strong winds and storms. The first sighting of land was on November 10, 1620 off Cape Cod, and in the following weeks they scouted along the coast for an area that would be suitable for founding the colony. Because they had been pushed so far off course and winter was rapidly approaching, they would never make it to Virginia – their intended destination.



While the early explorations of the land progressed, much of the ship's crew and passengers became sick, in addition to the scurvy from which they already suffered. This slowed the exploration efforts until December.

The initial exploration party, in a smaller boat designed to act as the forerunner, decided to land The Mayflower in a region inhabited by the Nauset Native American tribe. The native people the party initially encountered fled when they saw them. However, the following morning, they encountered a hostile response to their incursions. A brief shoot-out occurred and the Nauset retreated into the woods, not to be seen for several months.

The native populations in the area were justly skeptical of the arrival of new settlers. Thomas Hunt, who had kidnapped Squanto and a group of other Patuxet, had also kidnapped seven Nauset and sold them into slavery. Due to the hostilities they encountered, The Mayflower traveled further westward. It is uncertain if the exact date was December 11 or December 21, but on one of those dates, the land that would become the settlement was surveyed.

The Mayflower was brought to harbor at Plymouth and the Pilgrims settled in an abandoned Native American village. This happened to be the same village Squanto had found deserted due to epidemic by his former band, the Patuxet. The first winter descended with no time for preparations. More than half of the original settlers died between the landing date and March, largely due to starvation and diseases that had been contracted on the ship. By February the group was reduced to a ration of just five kernels of hardened corn per person. This is immortalized in Hezekiah Butterworths' classic poem:

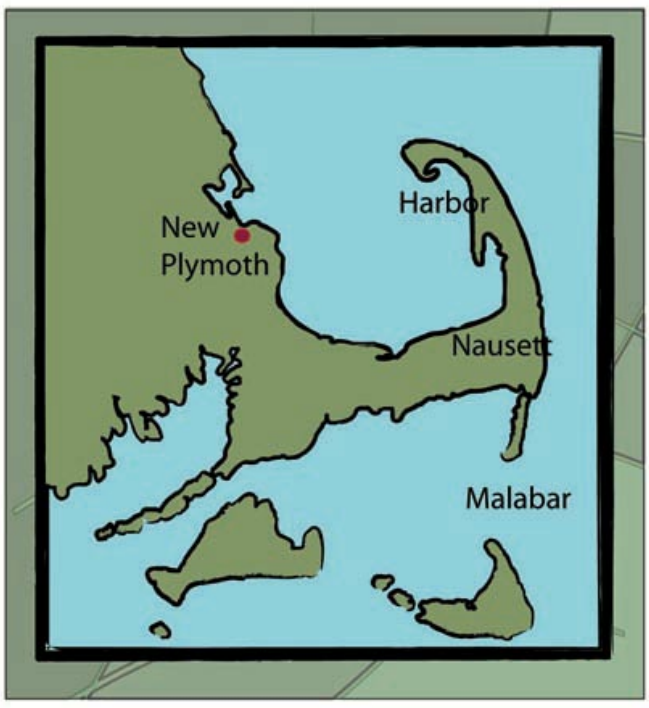
'Twas the year of the famine in Plymouth of old,
The ice and the snow from the thatched roofs had rolled;
Through the warm purple skies steered the geese o'er the seas,
And the woodpeckers tapped in the clocks of the trees;
And the boughs on the slopes to the south winds lay bare,
and dreaming of summer, the buds swelled in the air.
The pale Pilgrims welcomed each reddening morn;
There were left but for rations Five Kernels of Corn.
Five Kernels of Corn!
Five Kernels of Corn!
But to Bradford a feast were Five Kernels of Corn!

"Five Kernels of Corn! Five Kernels of Corn!
Ye people, be glad for Five Kernels of Corn!"
So Bradford cried out on bleak Burial Hill,
And the thin women stood in their doors, white and still.
"Lo, the harbor of Plymouth rolls bright in the Spring,
The maples grow red, and the wood robins sing,
The west wind is blowing, and fading the snow,
And the pleasant pines sing, and arbutuses blow.
Five Kernels of Corn!
Five Kernels of Corn!
To each one be given Five Kernels of Corn!"

O Bradford of Austerfield hast on thy way,
The west winds are blowing o'er Provincetown Bay,
The white avens bloom, but the pine domes are chill,
And new graves have furrowed Precisioners' Hill!
"Give thanks, all ye people, the warm skies have come,
The hilltops are sunny, and green grows the holm,
And the trumpets of winds, and the white March is gone,

Five Kernels of Corn!
Five Kernels of Corn!
Ye have for Thanksgiving Five Kernels of Corn!

"The raven's gift eat and be humble and pray,
A new light is breaking and Truth leads your way;
One taper a thousand shall kindle; rejoice
That to you has been given the wilderness voice!"
O Bradford of Austerfield, daring the wave,
And safe through the sounding blasts leading the brave,
Of deeds such as thine was the free nation born,
And the festal world sings the "Five Kernels of Corn."
Five Kernels of Corn!
Five Kernels of Corn!
The nation gives thanks for Five Kernels of Corn!
To the Thanksgiving Feast bring Five Kernels of Corn!



Outline map of Plymouth and Cape Cod with place names mentioned by Bradford

The First Meeting

During the spring thaw; as the new settlers surveyed their losses over the winter, a group of Native Americans came to meet with them. Three Native Americans were noted in historical records of the meeting. Massasoit was the political/military leader of the large Wampanoag tribe. Samoset held a similar position with an allied tribe to the north. The third noted native was Squanto, who held the position of a distrusted prisoner. Massasoit had brought him along as an interpreter, though records indicate he was reluctant to do so.

The Wampanoag had a good reason to attempt to establish a relationship with the settlers. The epidemic that had depleted so many of their number had left them vulnerable to attack from their long-time enemies, the Narragansett. It was feared that they would be overrun, so the leadership had determined that a potential alliance with the foreigners could be the best possible defense.

It is important to remember that by this point, the native populations around this area had become well accustomed to European visits. The Europeans would come and go on limited explorations. The local tribes allowed them to stay for brief periods before forcing them out, largely because of the trade opportunities they presented. The items they traded with the Native Americans, such as glass and metal were viewed with extreme value, especially given that these items were frequently traded for the abundant furs possessed by the natives.

It is interesting that the leader of the delegation, Massasoit, was unaware that The Mayflower colonists intended to stay. His intention in making an alliance with them was to grant them permission to stay, on the condition that they joined the Wampanoag in a formal alliance against the Narragansett.

Massasoit had determined to bring Squanto with him to meet with the Pilgrims because of his value as an interpreter. However, because of his time spent overseas

and as a captive of the Wampanoag, Squanto was not trusted. Massasoit harbored the concern that he would act to the advantage of the Pilgrims.

Samoset, the political/military leader of an allied tribe to the north, had appeared some weeks earlier, having "hitched" a ride on an English ship traveling down the coast. Samoset spoke a little English, and so he was the one Massasoit sent to make first contact with the Pilgrims.

It was during this meeting that Samoset famously greeted the Pilgrims, "Welcome, English. I am Samoset. Do you have beer?" The Pilgrims were surprised but glad to accommodate Samoset's request, as they had brought beer with them on the voyage. In fact, they had brought nine times more beer than water, because beer was much more potable. One of the first structures built in the New World by the Pilgrims was a pub, built from wood they had intentionally brought from England for just that purpose. This might strike many of us as strange who have been taught that the Pilgrims were hard, straight-laced folk; but the reality is that they were a lively group that worked hard, played hard and prayed hard.

After the initial contact was made, the first tentative negotiations began between the two groups. It was not without difficulty, and an uncomfortable standoff preceded the actual meeting between Massasoit and the colony governor. Eventually, however, the meeting took place, and over several days, a rough treaty was arranged.

Squanto and the Pilgrims

After the first meeting, Squanto moved into the Pilgrim's village to help them get settled. The story commonly taught in elementary schools of Squanto teaching the Pilgrims to plant corn with dead fish is true, according to historical accounts. However, it is now thought by many historians that Squanto actually learned that technique while in Europe, as there is little evidence that the practice was widespread among Native Americans.

Squanto's teachings regarding cultivating the land extended far beyond the fertilization technique for which he is remembered. The new settlers, with their numbers so depleted by their first winter, were in serious need of help. Squanto was such a blessing to the Pilgrims in fact, that William Bradford, later the governor of the colony claimed that he was "a special instrument of mercy and grace."

Looking back, it is easy to see the mistakes that they made. They had refused to pay Captain John Smith to lead their expedition, believing that they could do just as well with his maps of the region. However, the lack of familiarity with the land led to weeks of time-consuming explorations along the coast before finding a suitable spot to settle, leaving them very little time before winter set in. Upon landing, they did not have the necessary provisions to begin farming. They also failed to bring much, if any, livestock to produce food.

Squanto worked hard with the Pilgrims to prove his value. In addition to the fertilization technique for which he is so famous, Squanto also passed on traditional Native American planting techniques. One of these, which is considered foremost, is the Wampanoag Three Sisters Garden.

Native American tribes throughout the region used this gardening technique widely. It was thought that a family could sustain itself entirely on what was about an acre of land with the Wampanoag Three Sisters Garden. The garden was planted without any

plowing or tilling of the land. Traditionally, corn, beans, squash and sunflowers were planted.

This method of gardening was unlike anything seen in Europe. The sites were typically round in shape, as opposed to orderly rectangles. The corn was planted first in mounds about six inches apart. After the corn had sprouted, beans were planted on the sloping sides of the mounds. Squash seedlings were to be planted between the mounds, at the same time as the beans. The sunflowers were positioned on the northern edge of the garden, so as not to cast a shadow over the other plants.

Most of the surviving Pilgrims were not farmers by trade, however they followed Squanto's advice and set up their land accordingly. Over the course of the summer, they also learned how to fish the local waters.

In October of 1621, a healthy harvest was taken in. The food stores created were enough to ensure the colony's survival through the winter, something that had not been certain by any means a year earlier. As was typical in both Native American and English cultures, a feast was held in celebration of the harvest. This celebratory feast would come to be known as the first Thanksgiving.

The First Thanksgiving

The first Thanksgiving was likely very different from what has been portrayed in school pageants. Surprisingly, there were probably more Native Americans in attendance than Pilgrims. The records of colonist Edward Winslow, state that there were some 90 Native Americans at the feast, and it is known that there were only about 50 surviving colonists.

After their difficult struggle to survive, the Pilgrims were eager to celebrate their hard-won harvest. Although Squanto, with his skills in English, was the most noted of

Edward Winslow, 1651,

Painted in London by an anonymous artist, school of Robert Walker; Pilgrim Hall Museum, Plymouth, MA.

those who helped the Pilgrims, the entire Wampanoag tribe had also assisted them throughout. Accordingly, Massasoit and many others were invited to join the feast.

The Wampanoag provided much of the meat for the first Thanksgiving, in the form of wild game. Although it is unknown exactly what was eaten, deer and wild turkeys were likely on the menu. The Pilgrims, with their new crop stores, brought corn, beans, squash in addition to food they had learned to forage from the wilderness, like cranberries and sweet potatoes. It is thought that both Pilgrims and Wampanoag alike would have brought freshly caught seafood, like lobster, eel, crab and cod.

There are a few colonial accounts existing of the first Thanksgiving. One of these came from Edward Winslow. He wrote that after the harvest was taken in, some men were sent hunting for wild birds "…that so we might after a special manner rejoice together after we had gathered the fruits of our labor." He continued on to say that the men killed enough game to provide the colonists with food for a week. It is unclear how exactly the Native Americans came to join the celebrations, but he states that "amongst other recreations, we exercised our arms, many of the Indians coming amongst us, and among the rest their greatest king Massasoit, with some ninety men, whom for three days we entertained and feasted." Winslow also brings up the Wampanoag contribution to the feast, "…and they went out and killed five deer, which we brought to the plantation and bestowed on our governor, and upon the captain and others."

Winslow's account of the first Thanksgiving concludes with a statement that is reflective of what Thanksgiving has now become, "And although it be not always so

plentiful as it was at this time with us, yet by the goodness of God, we are so far from want that we often wish you partakers of our plenty."

This vibrant faith is also something they shared with their Native American guests. During the three day-long feast, a sermon was preached at which nine Wampanoag ended up converting to Christianity.

Squanto also became a Christian under William Brewster's preaching.

First Thanksgiving

Library of Congress, Prints and Photographs Division, Detroit Publishing Company Collection. [First Thanksgiving]. *Ferris, Jean Louis Gerome*, 1863-1930, artist.

Chapter Two

The Soil Then

The Pilgrims had intended to make landfall further south, in a more hospitable climate. However, the storms they had encountered at sea had pushed them off course. Having been weakened by their journey and illness, they had no choice but to settle in that region. At that time, they had no way of knowing about the soil quality of the region, and what it would mean to their crops.

To better understand the struggles of the Pilgrims to cultivate the soil, it is important to understand the land that they were trying to cultivate. We are going to briefly look at the geological history of the area.

The Geological History of Plymouth

The land on which the Pilgrim Plymouth was founded is volcanic in origin, which was covered in sand and gravel. During the Ice Age, heavy glacial activity dramatically shaped the landscape of the region, bringing soil, stone, sand and boulders with it, which were left as the glaciers gradually pulled back to the north.

This glacial "scouring" of the land resulted in a poor quality, acidic soil. The soil itself is mixed with many rocks and pebbles, so much so that even soil that has been cleared has new rocks coming up into it from below. In areas with good drainage, where topsoil formation is best, the topsoil is still only a few inches thick and filled with

rocky debris. To better understand this, it is worth noting that the rich topsoil of the Midwest can often be 13-14 inches thick. The soil's content is determined by the rock that formed it. In the case of this region, the mantle rock created a more acidic and less fertile soil.

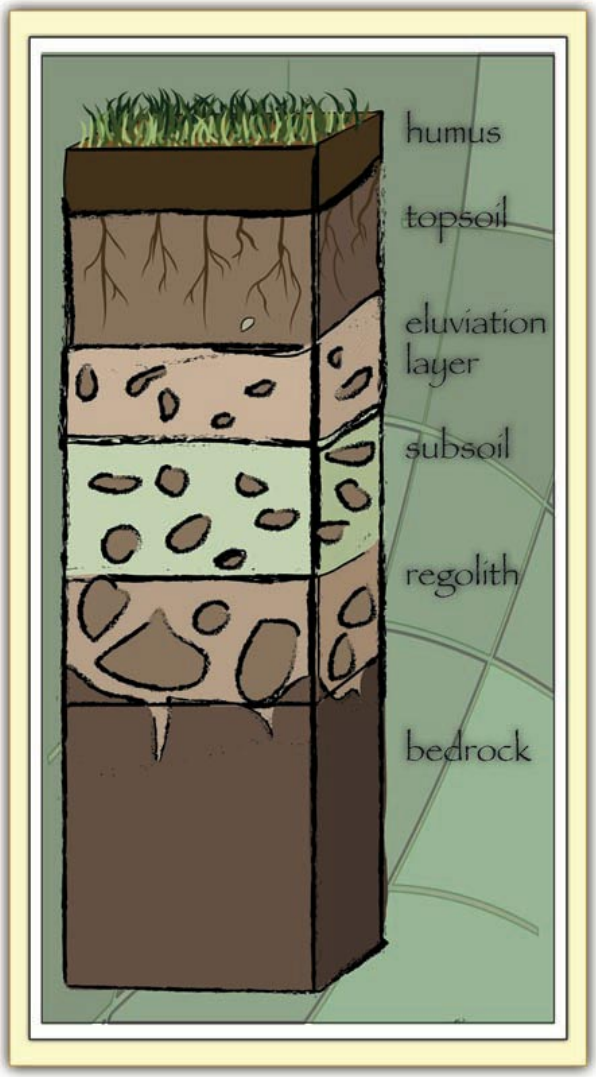
The Land Before the Pilgrims

Soil is the product of small pieces of rock. The larger particles are sand, while the smaller particles are silt and clay. Soil is made up of distinct layers that are referred to as horizons. The very topmost layer is called humus and is mostly decaying organic matter and decomposing leaves. The next layer is the topsoil. This is where seeds and plant roots grow. Below that is the eluviation layer, which is primarily composed of clay and silt. Subsoil sits below the eluviation layer, which contains more clay and mineral deposits. The final layer is bedrock.

Although all soil has these different horizons, their levels change in different regions. Sandy earth dries more quickly, while earth with silt and clay will retain water. The soil that is best suited to plant growth is called "loam," and contains equal portions of sand, silt and clay. Drainage is a major issue with soil quality as well. Soil which drains too readily will not have adequate moisture for plant growth, and areas that flood regularly will not be optimal for most plants because of too much water.

In the region that the Pilgrims settled, favorable soil conditions were not widespread, instead, they existed in scattered pockets. The forests of the New England region varied widely. It is thought that the absence of many kinds of grazing animals was in part responsible for the lack of open spaces in the area. A wide variety of nut producing trees such as Hickory, Oak and Chestnut, supporting a wide variety of animals including deer, bears, raccoons, squirrels and turkeys. They also formed an important part of the diet of the Native American populations that had long inhabited the area.

The first appearance of humans had a major influence on the land of the region and what it produced. Wood consumption was high because of the need to provide heat throughout the winter and also to smoke-dry meats and seafood that could be stored throughout the year. Systematic burning was used to clear leaves and underbrush in the fall to make hunting easier. Foraging for food also impacted what the land produced. Those who gathered food encouraged the growth of plants that had high food or textile value, and discouraged those with little value.



Improved growing conditions followed a warming period about 1000 years ago. This resulted in the wider adoption of cultivated corn, beans and squash that had already begun in the Ohio Valley. However, because the soil was not as good, the farming of corn did not have the greater impact that it had on Native Americans in other parts of the continent.

Settlements in the New England region were smaller, and typically not permanent. Though humans had inhabited the region for thousands of years by the time the first Europeans were exploring there, they had not depleted the resources of the area. To the contrary, wild game and fish were abundant and the controlled burning and selective harvesting meant that the forests contained bountiful food possibilities.

Native American housing was kept small and portable because they moved with the animals as the seasons changed. Because the growing season could be spoiled by an early frost, the inhabitants of this area did not give up the subsistence lifestyle that involved hunting and gathering for farming for a long time.

Gradually, however, the population growth expanded the corn cultivation in this region, with inhabitants spreading out into independent homesteads. The favored locations had always been those that provided access both to the forests and to water to provide for a variety of food. At this point, identifying good soils for growing corn, in particular those with a full southern exposure that ensured a full growing season, became another important factor in the movement of populations in the region.

The Land of New Plymouth

When the Europeans began their exploration of the region, it added a new element to the value of land. Those Native Americans who held the land between the forest and the ocean could control the trade of the items brought by the newcomers.

The early European explorers arrived during the summer months witnessing the bounty of the forests, the rivers and the ocean. They did not stay through the winter to see its harshness, and the ways in which the native people had adapted for survival. To their eyes, it appeared that the lack of large farming communities was due to a lack of civilization. However, the fact that the Native Americans of the region supported themselves through hunting and gathering and used farming only as a supplement was based very much on the land and the climate of the area they inhabited.

After barely surviving their first winter, the Pilgrim settlers had to attempt to build up food stores that would see them through the next winter. Their first attempts were not successful, and it was when they were shown the now-famous technique of planting a dead herring in the mound with each corn seedling that their crops began to grow.

Though this first lesson was enough to see the Pilgrims have an adequate harvest, it was not enough to help them flourish. The settlement was plagued by other farming difficulties.

The settlement had been planned for communal farming. However, even though they had enough stores to survive the first winter, it was clear that the growing colony could not be supported on the single communal plot. The food production was simply not high enough. So three years later, they abandoned the communal farming in favor of each family having their own plot of land and being responsible for their own food stores. The rise of independent farming proved very successful and essential to the survival of the settlement.

Many modern speculators have pointed to this as an indication of the triumph of family ownership over communal farming; given the soil conditions in the region, there may be additional explanation why this worked. The poor soil conditions were really only suited to small fields, rather than large farming tracts. When the Pilgrims switched to independent "family" farming, which cultivated smaller tracts of land, they also changed to a style of farming that best suited the land.

Another important part of the change to individual farms was that the Pilgrims began to imitate the style of Native American gardens through the use of companion planting techniques.

Through the adoption of these techniques, the New Plymouth colony survived its first difficult years and flourished. In the next chapter we will look at the science behind why the new techniques worked.

Chapter Three

Why Did Squanto's Methods Work?

Although it now seems more likely that Squanto learned about fertilizing with fish while he was in Europe, the reason that the Native Americans had succeeded in surviving and flourishing while the newcomers struggled is plain enough. The native people had developed techniques of getting the most from the land over thousands of years, while the Europeans had only experience farming in a very different climate and soil to base their decisions on. Squanto's advice was crucial if the Pilgrims were going to survive.

The reason that the fish worked to help the corn grow goes far beyond simple fertilization. True enough that the plants could feed and grow from the decaying organic material, but the fish also addressed deeper problems with the soil because of the calcium it provided:

- The calcium provided by the flesh and bones of the fish acted to raise the Ph of the soil, neutralizing the acidic soil of the region and allowing the plant to better absorb nutrients.
- Calcium also softens or mellows a soil, making it more porous by expanding the clay element of the soil.
- Calcium builds the strength of a plant at a cellular level, helping make it more resistant to draught and temperature changes.

◊ Calcium also acts to feed soil bacteria that are essential to plant growth.

The fish fertilization also provided the soil with high levels of quality nitrogen, phosphorus, potassium and sulfur that helped the plants to grow. Nitrogen contains protein that encourages the growth of the green part of the plant. Phosphorus stimulates root growth and promotes fruit and seeds as they mature. Potassium promotes plant vitality and resistance to disease. Sulfur contributes to important microbial life in the soil. Without adequate soil bacteria, minerals in the soil don't get broken down into usable nutrients for the plant. Squanto's fish fertilizer played a big role in increasing soil bacteria as well as improving the nutritional value of the plants grown with his methods.

These ears of corn demonstrate some of the differences mutations maintained at the Maize Genetics Cooperation Stock Center.*

The photo is image number K8712-1 at the USDA Agricultural Research Service, by Keith Weller. *Original caption with the photo.

Though the Europeans were accustomed to planting each type of plant in a separate portion of a field, that technique was not suited to the weaker soil they encountered in the New World. Companion planting has many benefits to the soil and the growth of the plants.

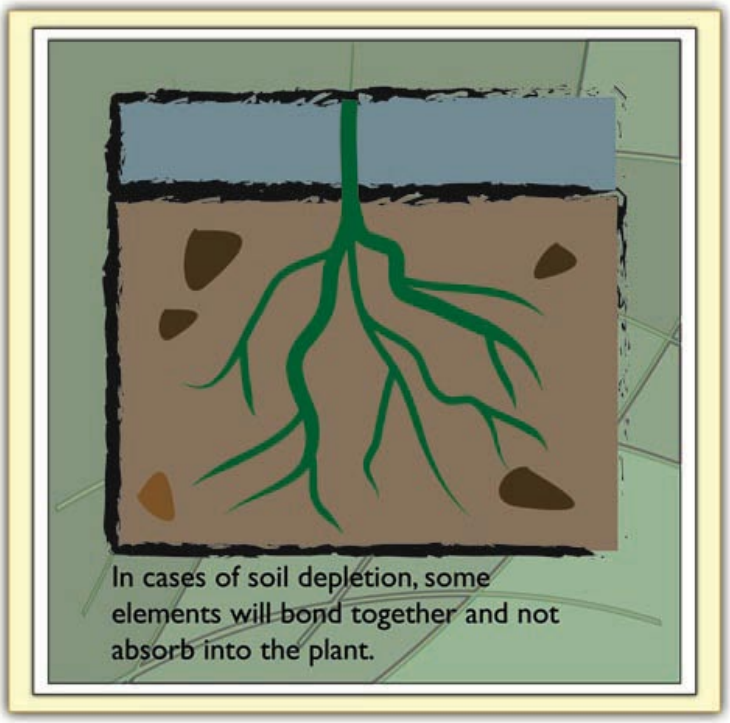
In the "Three Sisters" companion planting design discussed in Chapter One, the plants act to support the growth of one another while simultaneously enriching the soil. Though it would have been difficult to implement for large-scale farming, the technique is perfect for the small-scale fields that the Pilgrims eventually settled on.

Each of the plants acts to benefit the others in the "Three Sisters" design favored by the Wampanoag:

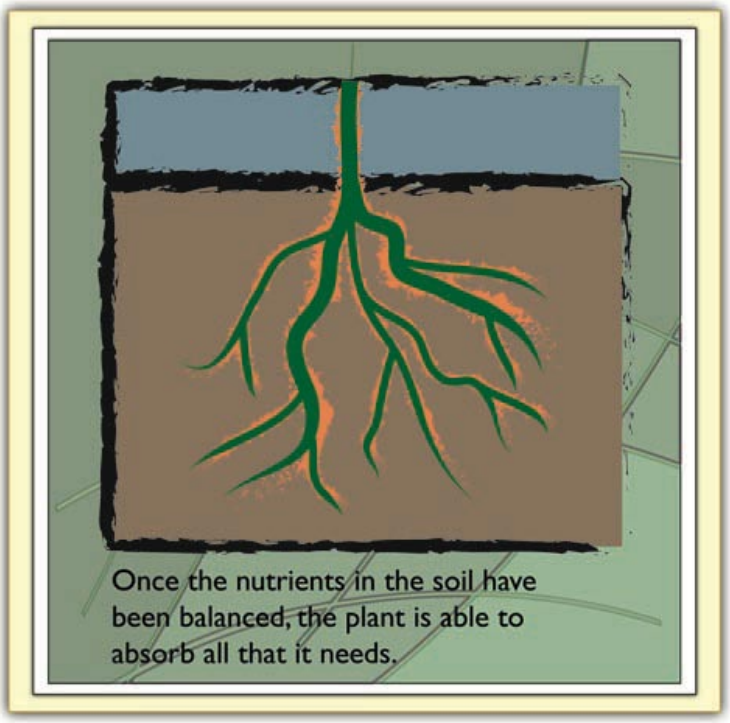
- The corn acts as a pole for the bean vines to climb, removing the need to use real poles or trellises.
- The beans are legumes, which add nitrates to the soil that the other plants need to grow. They do this by way of a "nitrogen-fixing bacteria" on the nodules of their roots. The bacteria work with the legumes to create nitrates.
- The squash provides ground cover that helps prevent weeds by denying them sunlight. It also helps to keep the ground moist by acting as mulch.

Tastes Better, Is Better

Not only would the vegetables that came out of Squanto's Garden have tasted better than vegetables grown in the traditional European style, they actually would have been much healthier to eat.



In cases of soil depletion, some elements will bond together and not absorb into the plant.



Once the nutrients in the soil have been balanced, the plant is able to absorb all that it needs.

As we have explored, the natural soil conditions in the area were not conducive to farming. The poor conditions also meant that not only was plant growth impeded, but what the crops that the land would have been able to produce there were not as good. Soil that lacks important nutrients will produce food that is lacking those same important nutrients. This is because of the importance of Trace Elements.

The importance of trace elements has only fully been revealed in recent years. Trace elements are those that we need for health and survival, but only in the smallest amounts. The poor soil conditions in the New England region would very likely have meant that the soil there lacked, or had very little of some vital trace elements. Soil that has been leached of a particular element will

cause an imbalance that may block the absorption of other elements, or cause other elements to be substituted.

The traditional European technique of fertilizing the land with manure would have worked to introduce some of the trace elements into the soil, but not others, because manure can only put back what was taken out of the soil in the first place. Fertilizing the soil of New England with herring worked much better because they were using a salt-water fish from the sea. Here the difference between land and sea makes a tremendous amount of difference. In the sea, there is no blocking or substitution of elements because of the liquid state of the nutrients that the plants are absorbing. Therefore, the fish consume all of the necessary trace elements.

By using the fish as fertilizer, both Squanto and the Pilgrims were unknowingly ensuring that their food contained all of the nutrients and trace elements that they needed to survive and be healthy.

Chapter Four

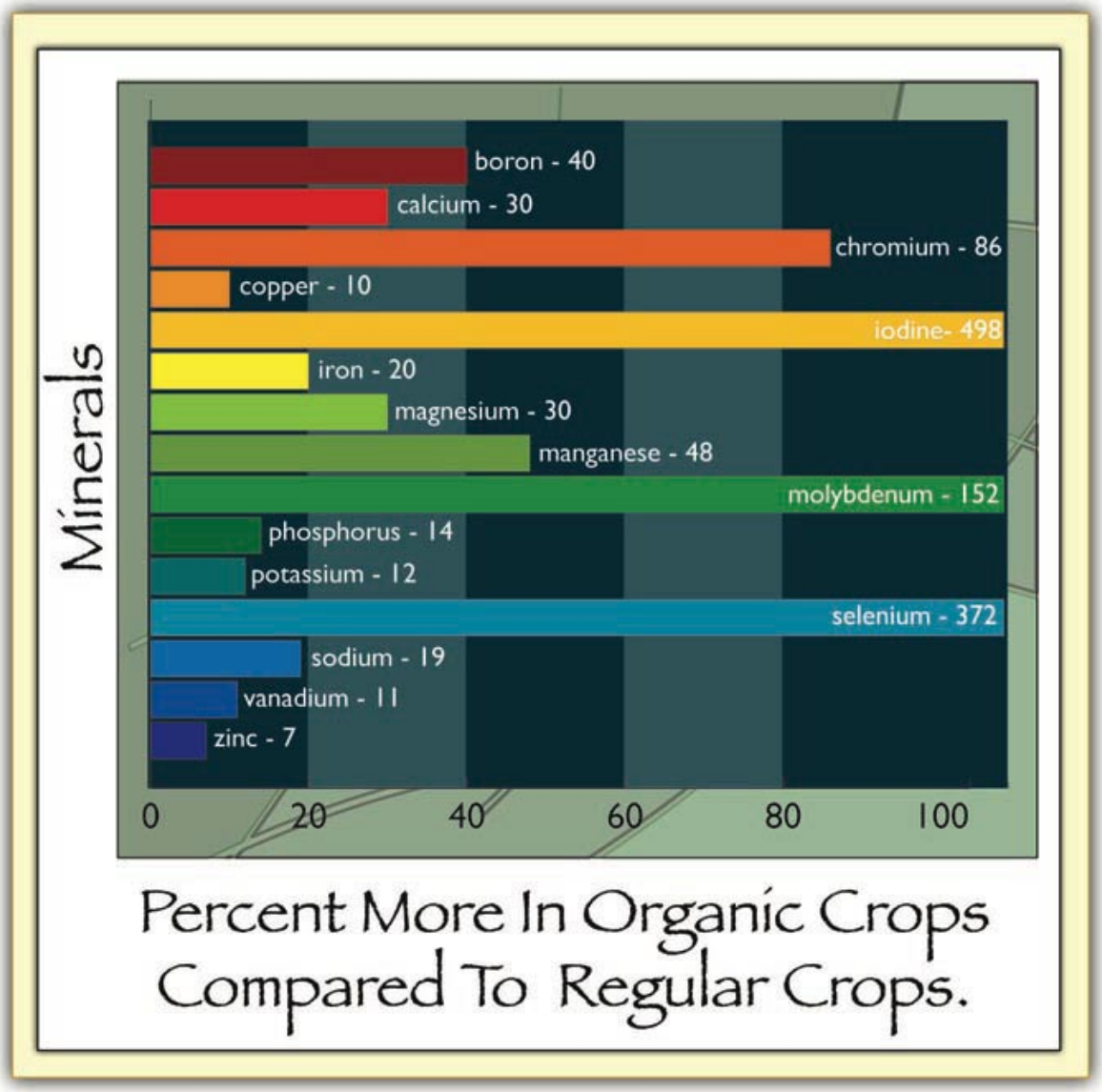
The Soil Today and What It Produces

Now we are going to move up to the modern day to look at the condition of the soil in the United States and around the world, and the food that is being produced.

Recent studies by the International Food Policy Research Institute have shown that the world's farmland is in increasingly poor condition. Only about 16 percent of the farmland around the world is free from soil problems like chemical contamination, acidity, salinity or poor drainage that affect soil fertility. The depletion of organic materials in the soil leads to a reduction in soil fertility and moisture retention. Aluminum contamination and excessive salt deposits also contribute to contamination issues. In comparison to the rest of the world, the United States has the best proportion of good land, with 29 percent of the farmland being free from these fertility problems.

Food produced by conventional farming is also being found to have lower nutritional quality. One study, published in Life Extension Magazine in 2001 by nutritionist Alex Jack, looked at the changing vitamin and mineral content of vegetables based on the US Department of Agriculture tables of the past and present. The story, entitled "Vegetables Without Vitamins," revealed that the levels of essential vitamins, such as Vitamins A and C, Calcium, Magnesium and Potassium, have dropped dramatically in just the last 40 years.

Basically, there is more food being produced, but it is of lower nutritional value to us. The emphasis has moved to creating good looking fruits and vegetables so that



people will buy them, with little thought going into their value as food or even their tastiness. It is easy enough to note on a trip to the grocery store: a tomato that appears large, red and free of bruises is often found to be tough, mealy, and unappealing. The taste of the item cannot be determined at the point of purchase, so appearance has become the primary concern along with crop yield.

The focus on appearance means that as vegetables are being bred, they are being grown to look good, to maintain their good appearance as long as possible, and to have the highest yields. The focus on high crop yields has caused farmers to introduce basic

elements of nitrogen, phosphorus and potassium plus lime to the soil. These added elements cause an immediate increase in crop yields; however, there is growing evidence that the build up of these elements in the soil is resulting in a blocking of the uptake of other essential trace elements.

Another study that was conducted in 2001 compared the nutritional value of conventionally produced fruits and vegetables to that of organically produced vegetables. It was conducted by Virginia Worthington and published in the Journal of Alternative and Complementary Medicine. Her findings showed that organically grown produce had higher levels of almost all vitamins and minerals and lower amounts of potentially harmful nitrates.

It is important to remember that these problems are not limited to affecting fruits and vegetables. Everything else from livestock to grains are effected by problems with the soil.

As the information above indicates, one of the best ways to address the issues of soil fertility and the lowered quality of what is being produced from it is through the practice of principles of organic farming.

Although larger issues loom for the world in general, by returning back to Squanto's lessons, you can create your own garden that avoids these problems.

Chapter Five
Squanto's Garden Today

In the previous chapters we have looked at the history surrounding the Pilgrims and the Native American Squanto. You have learned the true story behind what happened while the Pilgrims tried to settle, and how they were able to survive because of the things they learned from Squanto and other Native Americans. We explored the science behind the things they were taught, and why it works. You have also learned about the importance of soil and how it affects what grows on it, both in the Pilgrim's time and today. Now, everything you have learned will come together to show you how you can become a modern-day Squanto in your own garden.

The first thing we will be doing is assessing the condition of your soil and developing a plan for how to improve it using the organic principles that saved the pilgrims. Secondly, you will explore what you are going to grow in your garden. Third, we will look at some possible garden designs that are based on Native American garden designs and you will find out the step-by-step instructions for planting in three different regions of the country. Then, you will learn about caring for your garden the organic way. Finally, we will look at some recipes based on the types of food that would have actually been eaten at the first Thanksgiving, using the produce from your garden.

Assessing Your Soil and Developing a Plan

To start off, you will need to learn about the soil where you are creating your garden. This is really the only way to find out what it is that you are working with, and

create a plan of action to improve it to produce healthier and tastier foods in your own garden.

There are several ways to test your soil. You can collect samples and bring them in to your local agriculture office where they will test them for a small fee. You can also look into private laboratories where you could bring the samples in, or ship them. You can also find home testing kits in most gardening centers and test your soil yourself.

A soil test measures several different things. Firstly, it measures the pH of the soil. This is the acidity of the soil and affects how the plants take in nutrients. The test will also measure the levels of nitrogen. As with pH, it is important to have balanced levels of nitrogen in the soil. Too much can inhibit flower and seed formation while too little will leave plants vulnerable to injury, disease and infection. Another element measured by the test is the level of phosphorus present. Phosphorus is critical to the growth and development of a plant. Lastly, potassium levels are measured. Potassium is essential to underground vegetables, however, too much reduces a plants resistance to droughts and frost.

Gathering soil for your test is an important step because poor test samples will not give you an accurate assessment of your soil. You should plan to take samples from several places in the garden area to ensure that you gain an understanding of the possible variations in soil condition within your property. You will need clean containers or bags with labels that tell you which part of the garden the sample came from. Focus on taking samples where there are changes in elevation, areas of greater or lower sun exposure, and areas that have been cultivated previously. At a minimum, plan to take a sample from each corner of the garden and from the center.

If the soil is too wet to walk on, you should wait until it dries to collect a sample. You will want to avoid touching the soil with your hands, or with anything that has soil from another part of the garden. You also want to take soil from about 2 inches below the surface for the best test. Remove debris and stones from the sample as best you can.

Once you have your soil test results, whether from conducting a home test or sending it to a lab, you will need to know what to do with the results once you have them.

In terms of pH, soil can be either acidic, alkaline or neutral. The pH level for acidic soil is between 1 to 6.5. Alkaline soil has a pH of between 7.5 to 10. Neutral soil has a pH of 7. Most plants will grow best in a pH of 6, however the acceptable range is from 5.5 to 7. Just as the bones and flesh of the herrings that the Pilgrims buried with the corn provided calcium to neutralize acidity of their soil, you can use dolomite or oyster shell lime to achieve the same results. If you need to lower pH levels in an alkaline soil, you can do so with soil sulfur or gypsum. These additions will have the best effect when introduced to the soil in spring.

The other elements measured will give you an idea of what you need to fertilize your soil with to improve it for growing. Nutrient rich soil will give you a better yield and tastier produce, so this is not a step you want to miss. The most common soil deficiencies occur in the levels of nitrogen, phosphorus and potassium.

Just as the Pilgrims found the fish to be such excellent fertilizer, all of these major elements can be found in new fertilizer that utilizes full-spectrum nutrients from the sea. One such organic fertilizer that combines the micronutrients from a special kelp extract with the macronutrients of North Atlantic fish is called ProtoGrow™. ProtoGrow was designed to help almost any backyard gardener create the Squanto effect.

Remember when we looked at how the fish could provide trace elements that might not be found in weak soil? The use of fish introduced trace elements into the soil that it was lacking in the Pilgrim's time and this sea-based fertilizer uses that same successful technique. In this way, it goes far beyond traditional fertilizers to replenish and restore your soil for optimum plant growth.

What to Grow

Throughout this book we have talked about the traditional items planted by the Pilgrims such as corn, squash, beans and sunflowers. However, obviously you need not limit yourself to just those. In part, what you choose to plant will be determined by the region of the country you live in. We will be looking at the "Three Sisters" garden design along with a couple other Native American garden designs. These plans all lend themselves to companion planting, which as we discussed earlier, has many beneficial effects, both for the soil and for the care and maintenance of the plants. Remember that one of the best aspects of this type of gardening is that it allows you to work with nature rather than against it.

As you select your seeds, remember that genetically modified and hybrid plants might go against your intentions with your garden. Using organic seeds provides you with the knowledge that they were not tainted by harmful pesticides. In recent years, there has been a trend towards heirloom plants which were commonly grown at earlier points in human history, but are not used in modern, mass agriculture. These can be a beautiful and tasty alternative.

Now, let's have a look at some great companion planting combinations you might want to try. The first plant listed is the primary crop, while the others can be included or excluded as you like. If there are any known incompatibilities with other plants, they are listed. Remember, if something is not compatible with the companion planting combination you want, you can still create a separate area for that plant in your garden.

- Asparagus goes well with Tomato, Parsley and Basil.
- Corn goes well with Irish Potato, Beans, English Pea, Pumpkin, Cucumber, and Squash but not Tomato.
- Carrots go well with English Peas, Lettuce, Rosemary, Onions, Sage and Tomato but not Dill.

- ◊ Any type of Cabbage goes well with Aromatic Herbs, Celery, Beets, Onions, Chamomile, Spinach and Chard but not Dill, Strawberries, Pole Beans or Tomato.
- ◊ Lettuce goes well with Carrots, Radish, Strawberry and Cucumber.
- ◊ English Peas go well with Carrots, Radish, Turnip, Cucumber, Corn, and Beans but not Onion, Gladiolus, Irish Potato.
- ◊ Irish Potato goes well with Beans, Corn, Cabbage Family, Marigolds and Horseradish but not Pumpkin, Squash, Tomato, Cucumber and Sunflower.
- ◊ Spinach goes well with Strawberry and Faba Beans.

Garden Design

We are going to look at a few gardening designs, all of which make use of the "Three Sisters," corn, squash and beans. The garden designs are different because of the different climates and soil conditions in varying regions of the country. They are presented here for you as a model, however, you can adapt them to suit your own region and what you are planting in your own garden.

Wampanoag

This is the design that is most traditionally associated with Squanto and the Pilgrims. Many of the Native American tribes of the Northeast used this garden design. This garden is traditionally planted in a round shape, however, feel free to modify it if it does not suit your gardening area. Keep in mind that it would be possible to create a round shape within a rectangular one, and use the corner portions for gardening other plants that do not suit your companion planting.

First, you will need to form the mounds for the beans and corn. Each mound is about four inches high, with a wide base about 18 inches in diameter. Each of the mounds should be four feet away from the other mounds, measuring from the center of each mound. You can conserve moisture by forming a crater like depression on the top of each mound. Plant four corn seeds six inches apart from each other, three inches into the mound.

At the same time you plant the corn, you can also plant the sunflowers. The sunflowers should be positioned at the North end of the garden so that they do not block sunlight. The sunflower mounds should be placed about three feet apart. Three seeds in separate holes can be planted at the top of each mound.

Squash should be planted in the house in pots or seed trays to allow it to develop into seedlings ready for planting.

At this point you have finished the first step and now must wait for the corn to grow to a height of four inches. Once that has happened, you can plant four bean seeds on the sloping sides of each mound. This is also the point at which you will plant the squash seedlings. You will build mounds in between the corn mounds about three inches high and a foot in diameter. Plant four squash seedlings on the top of each mound. Many varieties of squash can be planted in the same garden.

Sunflower Seeds
Plant seeds in separate holes a the top of each mound. Place mounds three feet apart.

Squash Seedlings
Plant seedlings in 3 inch high mounds, a foot in diameter.

Corn seeds
Place seeds in 4 inch high mounds, 18 inches in diameter. Place mounds 4 feet apart.

Beans
When the corn reaches 4 in. height, plant seeds in slope of corn mound.

WAMPANOAG

Hidatsa Gardens

This type of garden was the typical design for Hidatsa, Mandan, and Arikara peoples who lived in the Northern Plains, in what is now North Dakota.

Hidatsa gardens differ from Wampanoag gardens because they are generally rectangular in shape. They have alternating rows of corn and beans. Like the Wampanoag there are sunflowers planted along the north edge of the garden. Squash is planted after every fourth row of corn and beans and also used to border the other edges of the garden.

In the Hidatsa garden, there are usually four corn mounds per row of corn. Hidatsa corn mounds are constructed with the same measurements as the Wampanoag corn and beans mound. The difference is that only corn is planted in these mounds and that eight seeds are planted on the top of each mound. By growing the corn together in bunches the Hidatsa garden offers extra support and protection from the elements, something which was important in on the wide expanses of the plains where there were few wind breaks.

The bean mounds should be positioned between the rows of corn in a staggered, alternating pattern. The mounds are rounded and oval shaped, about 4 inches tall by 7 inches wide by 14 inches long. Bean seeds should be planted on the south side of each mound. One seed is planted in each hole, with a total of six seeds planted in each mound.

About two weeks after the initial planting, you will be ready to plant the squash. The squash mounds will be about 15 inches wide with four feet between the centers of the mounds. The squash mounds are positioned at the east, west, and south edges of the garden. To protect them from being washed away by rain, four seedlings are planted on the sides of the mound in sets of two, 12 inches apart.

Sunflower Seeds
Plant all three seeds in one hole at the top of each mound. Place mounds three feet apart.

Squash Seedlings
Plant sets of 2 seedlings on either side of the mound, 12in. apart. Mound 15in. diameter.

Corn seeds
Plant 8 seeds on the top of each mound. Mound is 18 in. diameter. Place mounds 4 feet apart.

Beans
Mound should be 7x14in. Plant seeds along south side of the mound.

HIDASTA

As with the Wampanoag garden, three sunflower seeds are planted in small mounds 3 feet apart along the north edge of the garden. As opposed to the Wampanoag technique for the sunflower seeds, three seeds are planted in one hole.

Zuni Waffle Garden

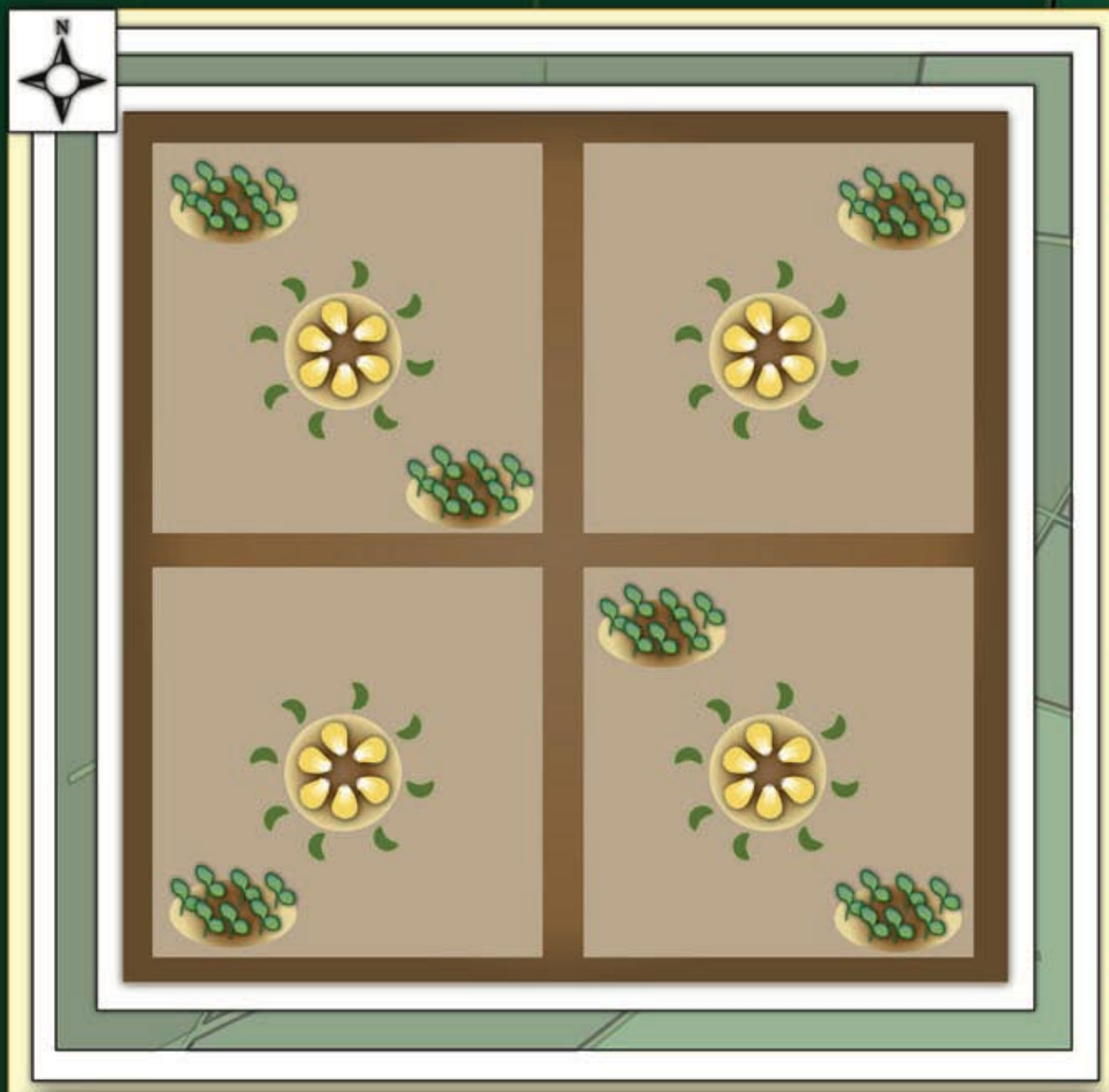
The Zuni people were from the Southwestern United States. Located in the area where modern Utah, Colorado, New Mexico and Arizona meet, a dry climate and altitudes of over 7,000 feet made gardening uniquely different from other regions of the country. The raised mounds of the Wampanoag and Hidatsa gardens kept the root systems from being over saturated with water. In the Zuni Waffle garden, water conservation was paramount.

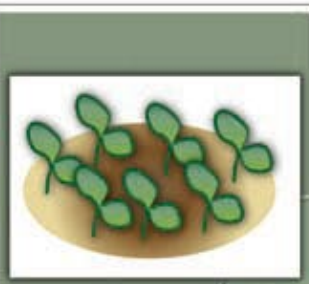
The "waffle" in the name refers to terracing that reflects that of a real waffle. The waffles were about 12 feet by 12 feet in size. They are filled with a grid pattern made up of large squares that were indented and surrounded by a high rim. A single crop or combinations of crops may be planted in each square. This garden design works well in areas that experience dry summer conditions.

In the traditional Zuni Waffle garden, the crops are planted close together. Five to eight corn seeds go in each hole to create clumps of corn similar like in the Hidatsa garden. Plant the corn seeds four to eight inches deep if the soil is light and sandy. Plant the corn seeds four inches deep or less in soil that is heavy with clay.

Beans and squash have the same planting depths as the corn. Four to eight bean seeds should be planted in a circle around the clumps of corn, with only one seed in each hole. Only one or two squash plantings, with four to eight seeds in each hole are put in each waffle square.

As with the both of the other gardens, sunflowers may be planted along the edges of the Zuni Waffle garden.





Squash Seedlings
Plant 4-8 squash seedlings, 4-8 inches deep in the earth.

Corn seeds
Plant 4-8 seeds in each hole.

Beans
4-8 beans in their own holes planted in a circle around corn.

Zuni Waffle Garden

Caring for Your Garden

Companion planting is a great technique because it very much reduces the amount of weeding you have to do. With this, you will find that gardening itself becomes a much more pleasant task. However, there are still a number of considerations to take into account in keeping your organic garden healthy.

Re-applications of Protogrow™ will provide your plants with nutrients throughout the growing season. Spraying in the morning or late evening will ensure maximum absorption by the plant.

There are many other techniques you can use to help your garden grow. Rather than using chemical pesticides, you can use nature to control the insect population in your garden. Just a single bird will eat hundreds of thousands of insects in a single year. You can bring birds to your garden by bearing in mind that they have four basic needs: food, water, shelter and a place to raise their young. By providing one or all of these needs in your garden, you can attract birds that will effectively control your insect population without any chemicals at all.

The use of composting is an excellent way to encourage and promote earthworms in your soil. Earthworms mix up the soil and stimulate microbial activity. They also introduce valuable aeration to the soil as they tunnel. Always be careful not to apply chemical fertilizers (any of the common white powders) to your garden. These products kill or drive away earthworms as well as other microbes vital for a fertile, living garden. Composting will also add beneficial soil organisms that will protect the plant from predatory life forms.

If your companion planting does not provide the level of ground cover that squash does, you may want to consider laying down mulch. Mulch helps to maintain a good level of moisture in the soil.

Recipes

Onion Sauce for Turkey

Sauce for a Turkie

Take faire water and set it over the fire, then slice good store of Onions and put into it, and also Pepper and Salt, and good store of the gravy that comes from the Turkie, and boyle them very well together: then put to it a few fine crummes of grated bread to thicken it; a very little Sugar and some Vinegar, and so serve it up with the Turkey.

Gervase Markham , The English Huswife, 1623

- 6 medium onions, sliced thinly
- 2 cups of water
- 2 teaspoons of coarsely ground pepper
- 1 teaspoon salt
- 1 tablespoon sugar
- 1/4 cup red wine vinegar
- 1/4 cup breadcrumbs (optional)

Follow your favorite recipe for roast turkey. Remove the turkey to a platter reserving the pan juices.

Place thinly sliced onions in a pot with water and salt. Bring to a boil over medium high heat and cook until the onions are tender but not mushy. A good deal of the water should have boiled away. Set aside for a moment.

Place the roasting pan over medium heat and stir to loosen any brown bits. Stir in the onion sauce, sugar, vinegar and breadcrumbs if desired. Add pepper to taste and adjust seasonings. To serve, pour over sliced turkey or serve alongside in a separate dish.

Stewed Pumpkin

The Ancient New England standing dish.

But the Housewives manner is to slice them when ripe, and cut them into dice, and so fill a pot with them of two or three Gallons, and stew them upon a gentle fire a whole day, and as they sink, they fill again with fresh Pompions, not putting any liquor to them; and when it is stew'd enough, it will look like bak'd Apples; this they Dish, putting Butter to it, and a little Vinegar, (with some Spice, such as Ginger.) which makes it tart like an Apple, and so serve it up to be eaten with Fish or Flesh.

John Josselyn, Two Voyages to New England

- 4 cups of cooked (boiled, steamed or baked) squash, roughly mashed
- 3 tablespoons butter
- 2 to 3 teaspoons cider vinegar
- 1 or 2 teaspoons ground ginger
- 1/2 teaspoon salt

In a saucepan over medium heat, stir and heat all the ingredients together. Adjust seasonings to taste, and serve hot.

Sobaheg made with Turkey

A Wampanoag Recipe

Wampanoag word for stew is Sobaheg. This stew makes use of the supplies they would have had on hand for the first Thanksgiving. It can be made today with, or without turkey.

- 1/2 pound dry beans (white, red, brown, or spotted kidney-shaped beans)
- 1/2 pound yellow samp or coarse grits
- 1 pound turkey meat (legs or breast, with bone and skin)
- 3 quarts cold water
- 1/4 pound green beans, trimmed and cut into 1-inch lengths
- 1/2 pound winter squash, trimmed and cubed
- 1/2 cup raw sunflower seed meats, pounded to a coarse flour
- Salt and pepper to taste
- Fresh or dried herbs such as thyme, rosemary, parsley or dill to taste

Combine dried beans, corn, turkey, and water in a large pot. Bring to a simmer over medium heat, turn down to a very low simmer, and cook for about 2 1/2 hours. Stir occasionally to be certain that the bottom is not sticking.

When dried beans are tender, but not mushy, break up turkey meat, removing skin and bones. Add green beans and squash, and simmer very gently until they are tender.

Add sunflower flour, stirring until thoroughly blended. Season to taste.

Made from corn and beans, this is a nourishing dish that has been made by generations of Native People. In the old way, a woman soaked the corn and beans overnight in a kettle of water. The next day, she cooked green onions (scallions) in a small amount of bear fat. The corn and beans were added, enough to feed a family (there were no measuring cups in those days). Then a good amount of water was added and the pot was left to simmer over the open fire until it made a rich broth. Sometimes corn flour or crushed nuts were added to help thicken the broth. Chunks of meat could be added to give the dish more flavor.

Corn and beans are Native foods. Now you know that this dish began with Native People on this continent. Today it is popular all over America.

- 1 can yellow corn
- 1 can red kidney beans or lima beans, drained
- 1 medium white onion, or one cup scallions, chopped
- 3 Tablespoons oil
- 1 lb. Lean ground beef
- Salt and pepper to taste
- Cook onion in oil until lightly browned.
- Add beef, stirring constantly until browned
- Add corn, beans, salt and pepper to meat mixture.
- Add enough water to cover and simmer on a low flame. If it starts to get dry, add a little more water. You can simmer the succotash for up to 30 minutes.

Conclusion-Squanto's Legacy

Through learning about the history of the Native American Squanto and the Pilgrims, you have discovered how to grow healthier and tastier vegetables and learned how to work with nature to create an organic garden. However, the lessons you learned in this book have applications outside of your backyard as well. The International Fertilizer Industry Association (IFA) and the Food and Agriculture Organization of the United Nations (FAO) held a joint conference in 2003 in which they identified four specific policy recommendations and considerations:

- ◊ Partnerships are vital to end hunger.
- ◊ Human nutrition needs to be improved.
- ◊ Soil degradation threatens food security.
- ◊ Sustainable fertilization needs to be further developed.

These recommendations and considerations line up very well with the lessons that the Pilgrims had to learn in order to survive and flourish when first arriving in the New World.

The Pilgrims would not have survived without the assistance of Squanto and the Native Americans. Similarly, much of the world today exists in poverty and hunger. A willingness to share information and freely help those less fortunate, the philosophy characterized by Squanto is necessary to end hunger around the world today.

Though the Pilgrims harvested enough to ensure their survival through the second winter, it was critical to their later survival that they improve the nutritional value of

their food. In the same way, the decreasing nutritional value of food is something that must be addressed today to improve human nutrition.

The Pilgrims had to learn how to properly cultivate the land that they did have, being mindful always of the best methods to maximize the condition of the soil. This lesson is essential to the sustaining farming in developing nations where degraded soil conditions reduce productivity.

The fertilization technique taught to the Pilgrims by Squanto was so successful and was able to be sustained because of the ready availability of the necessary fish that provided enrichment to the soil. Greater emphasis needs to be placed today on finding ways for farmers the world over to have access to fertilization that can help them improve the quality of their crops. We can begin that process by looking to the valuable lessons of Squanto's garden and using the farming secrets that led to the First Thanksgiving and the successful settlement of the New World.

Resources

1491: New Revelations of the Americas Before Columbus by Charles C. Mann
An excellent and complete history of European exploration and settlement in North America.

http://www.smithsonianmagazine.com/issues/2005/december/squanto.php
This article explores the Native Americans in New England and their relationship with the Pilgrims

http://americanhistory.suite101.com/article.cfm/SquantoAndTheMayflower
Another resource with information about Squanto and the Pilgrims

http://hubcap.clemson.edu/~blpprt/bobweb/bobweb.html
This site answers many questions people have about soil testing.

http://attra.ncat.org/attra-pub/complant.html
Here you will find more information about companion planting.

http://www.mindfully.org/Food/Organic-More-Nutritious-WorthingtonNov01.htm
This study compares the nutritional value of organically grown foods to those produced by traditional farming.

http://www.lef.org/magazine/mag2001/mar2001_report_vegetables.html
This study looks at how the nutritional content of produce has decreased over the years.

http://www.protogrow.com/
The website for Protogrow, where you can learn more about soil depletion, trace elements and how to replicate the techniques that Squanto used to enrich the soil and save the Pilgrims.