

#27 November 2021

Green Thoughts

Conversations and ideas about growing at The Spring Gardens

It is fun to look back on spring and summer and early fall and see how all our crops did. There is much to gloat about. The plants do most of the work and the sun bathes them with its considerable and somewhat benign energy. We watered once in a while when the rain was not

*Tomato
Puzzles*

consistent. But this year the rains were fairly regular. Not much to complain about. So we take off our hats to the various crops from early to

*Our Hydraulic
Society*

late (not a comprehensive list): Hardy lettuce and spinach that wintered over and garnished our BLTs; Radishes that are always great in salads; Peas that we ate straight out of the pod or ate the pod itself; Kale always in good taste; Bok choy, very sturdy and easy to grow and we can recommend; May strawberries that are wonderfully prolific and delicious; Beans including bush varieties, pole varieties and gita have been plentiful and we have been harvesting them, eating them and freezing the rest from early summer to Halloween. In the last Green Thoughts we talked about cucumbers plants that have produced bumper crops for some (but not all) of our fellow gardeners. Across TSG people have cultivated peppers both sweet and hot. Until November when we had a spell of days where the night temperatures fell to the upper 30's, the pepper plants looked terrific and produced heavy yields. I harvested 5 full size bell peppers on Halloween day. Spices have been plentiful – including oregano, dill, rosemary, fennel, sage, basil, chives, parsley – they held up their end of the bargain. And more exotic perennials such as asparagus and artichokes are looking quite excellent. As we move more deeply into fall 2021 fellow gardeners have planted various greens and radishes, broccoli and kohlrabi and they are looking resilient and unfazed by the prospect of cooler temperatures.

Whither Tomatoes?

Tomatoes this year that have been less reliable than in past years. Usually we keep picking tomatoes into November. I have imagined that someday, with global warming, we might be able to harvest tomatoes on Thanksgiving day (in tropical southern Nigeria, where it never gets cold and gets lots of rain, I have seen indeterminate varieties that have been encouraged and supported to grow as high as two story buildings in two years). This year

at TSG there have been tomato plants that gave up the ghost very early and other tomato plants that said their goodbyes in early August. Even the usually reliable and productive Sungold cherry tomatoes didn't make it to the normal finish line.

There wasn't uniform devastation. Some tomato plants made it through October (see next page). But what happened to the rest? The short answer is we don't know. Many of us weren't paying enough attention.



a healthy tomato plant
photographed on
15 October 2021



orphan cherry tomatoes
clinging to desiccated
plant. Photo on taken
same day as one on left

There are lots of possible explanations about what might have occurred. In the future we will start looking at our tomato plants more carefully as they grow. If you look in seed catalogues under tomatoes they list varieties that have been bred to resist various threats. Even with an incomplete list the threats are formidable: verticillium, different varieties of fusarium, nematodes, tobacco mosaic virus, *alternaria* stem canker, *stemphyllium* gray leaf spot, tomato spotted wilt virus, early blight, late blight. Good grief.

Let's delve a little deeper into the specifics. Verticillium (V) is a soil-borne fungus. The first sign of V infection is that there are yellow blotches on the lower leaves of the tomato plant. The fungus moves into the plant from the root hairs and grows up the stem via the xylem and the plant becomes stunted. The top-most leaves stay green. The fungus produces a toxin that aids in the wilting of leaves.

Fusarium (F) is another soil-borne fungus. There are various forms. It clogs the plant's vascular tubes which carry food and water and works faster at damaging the plant than V.

Nematodes (N) are tiny, one millimeter length round worms also found in soil. Some species are parasitic and affect tomato roots. They tend to do their damage below ground concentrating on chewing on the roots which leads to stunting of plants but also weakening them so that other infections are more likely. [By the way, a certain variety of non-parasitic, bacteria-eating soil nematode has been studied intensively. It is called *Caenorhabditis elegans* (or *c. elegans*). It has only about 1,000 cells of which about 300 are neurons. It was the first animal to have its whole genome delineated. We now know exactly how it develops starting with a single cell until, by successive divisions, it forms a complete adult organism. We know which cells make it all the way to adulthood and which cells are programmed to die during development. We know how all the individual cells are physically arranged in the worm and the details of how they function and how they are connected. The work has led to important molecular discoveries that were later found in other animal species, like apoptosis or programmed cell death during development. Over the years seven Nobel prizes have been awarded scientists for discoveries they made in *C. elegans*.]....

There are viruses that do a number on tomato plants including tobacco mosaic virus (T). T was first studied for its effects on tobacco but it also affects tomato plants. There is also the tomato spotted wilt virus (TSWV) which is spread by thrips, tiny winged insects.

There is also Early Blight due to *Alternaria* (A) fungus which affects foliage and stem and even the fruit of tomatoes. And another fungus *stemphyllium* (St) gray leaf spot messes up leaves and turns them chlorotic, i.e. yellowish because they lack chlorophyll.

Finally, this incomplete list also should mention late tomato blight (LB), caused by oomycete pathogen, which first attacks leaves especially the smaller more succulent leaves but then attacks the fruit. It is fungal-like but is more related to brown algae. It also affects potato plants and wiped out a significant portion of the potato crop in Ireland in the middle of the 19th century and was the key factor in the devastating Irish potato famine that killed many people.

So we are up against it when we grow tomatoes. How innocent we have been! By talking to fellow gardeners and reading some of the literature there are a few things we might do to mitigate some of the diseases of tomatoes. Here is a compendium of suggestions:

What can be done?

First, rotate the crop. Don't plant tomatoes where you planted them last year. That helps but it is certainly no guarantee because these fungi and viruses and nematodes can survive in the soil for years.

Water early in the day and don't over soak. Don't water if it has rained recently or is supposed to rain soon.

Buy resistant breeds of tomato. That is harder to do if you buy plants because most store-bought plants don't list what the breed is resistant to. But here are a few varieties with their specific resistance – Better Boy (VFN); Beefmaster (VFNASt); Defiant (VFEBLB); Sungold (FTSWV); Sweet Million (FT) Sun Sugar (FT). These days I don't start tomatoes from seed simply because I don't have a greenhouse or grow lights to get them started early enough. In the past when I started from seed the plants were leggy and small. But maybe I should go back to starting from seed.

Another observation that may be useful is from our friends at City Harvest. If it is too hot a summer, where the heat is unremitting, tomatoes don't do so well. There is a breed of tomato, Estiva, that is more hardy in sustained hot weather. Also, it has been suggested that there may be some advantage to buying from local nurseries that grow their own tomato plants from seed since the plants are adapted, in some way, to our local conditions. Finally, this past summer was wetter than usual and maybe that didn't help. The variety that did the worst for me is called Biltmore. It started out fine, produced a few tomatoes but then was stopped in its tracks. If asked, I would suggest the variety be renamed Biltless.

Most of us grow tomatoes because we love them. So let's exchange information about which types of tomato plants do well and which types do not. Gardening is ad hoc and we learn from each other. And we'll keep growing tomatoes because they help make the summer special.

TSG: another hydraulic society

Some of the great ancient civilizations took advantage of nearby rivers and other bodies of water to sustain large, productive, and stable populations. We all know about the Nile River that flows north through the vast Saharan desert but whose delta has been an immense oasis for millennia. Irrigation has been used to enrich the land during the Nile's annual flood before it empties into the Mediterranean. In ancient times the City of Alexandria, at the northern terminus of the Nile delta housed a great library whose enormous collection, some say its 400,000 papyrus scrolls encompassed much of the world's knowledge. It was founded by the

Egyptian pharaoh Ptolemy II Philadelphus. [It does not seem to be the case, despite his name, that he invented either the cheesesteak or the soft pretzel]. The library lasted for hundreds of years but eventually withered away. We don't know whether it had texts on farming and gardening.

The Tigris and Euphrates rivers, both originating in the mountains of Asia minor, spilled out onto a desert plain and the locals built aqueducts to irrigate the land between the two rivers to enable the kingdom of Babylonia to grow into a great "cradle of civilization." The emperor Nebuchadnezzar built the Hanging Gardens which was considered one of the seven great wonders of the ancient world. The Pergamon Museum in Berlin houses enormous collections of material crated (stolen) away from Babylonia.

Other extensive empires were established along the River Ganges in India and the Yang Tse River in China. The great Mekong River begins in the southern mountains of China and flows through southeast Asia and seasonally feeds the very large lake Tonlé Sap in Cambodia which provided water the building of Angkor Wat. It is estimated that in ancient times about one million people could have lived near Angkor. Closer to home, the people of Cahokia lived near the eastern edge of the Mississippi River across from what is now St. Louis, Missouri. Cahokians lived in a city that had a population greater than Paris or London at that time. Cahokia is on the border between the vast, flat grasslands of central Illinois, Iowa, Indiana and Ohio to the north and the forests to the south. They traded up the Mississippi even venturing into the Great Lakes and all the way down to the Gulf of Mexico. They built great earthen mounds that have been preserved in a state park. Its largest

mound has a base area equal to the base area of the great Pyramid at Giza.

We should mention the Imperial Valley in the Sonoran desert at the southern edge of California. In winter it provides vast amounts of vegetables and fruit to the United States through irrigation from the all-American Canal which bleeds the Colorado River of virtually all of its water. Virtually no water from the Colorado currently makes its way into Mexico which used to have green and fertile land adjacent to the river on its way to the Gulf of California, aka, the Sea of Cortez.

So that leads us to the next great water work presently being constructed at The Spring Gardens under the leadership and design of fellow gardener Russ Troyer. We are of course near the Schuylkill River which originates in the little town of Tuscarora about 30 miles north of Reading. We have been permitted to tap into one of the City of Philadelphia's water mains maintained with water kept at 60 pounds per sq inch. So we have a reliable source of fresh water without compromising water for the rest of the city. We are no Imperial Valley.

As you know, TSG gardeners have been watering their plots by filling their pails with water stored in the blue plastic cisterns distributed along 4 east-west paths of TSG. It has been a pretty good arrangement but it is laborious. It requires a whole committee of people to refill the cisterns twice a day. In the new design, overseen by Russ, there will be spigots arrayed along the 4 east-west paths where the barrels used to be. These spigots, aka hydrants, will obviate the need for the blue cisterns and for people to fill them. It is a work in progress right now. The first work is being done in the northwest quadrant of TSG. The work started on 7 November. The (Continue on page 6)

Digging and Filling – *The water project begins*



All the panels are looking east from the 19th St gate. Digging of the trench was slow-going at first. The left panel shows the work almost at the end of the first day. Con is at the controls of the Bobcat excavator. He carefully avoided messing up the garden plots on either side. The dirt had to be removed and temporarily piled up at the central lawn. The next panel shows the completed trench extending from 19th St to the central lawn at the end of the second day. The bottom of the trench is dry along its whole length. The blue barrels have been emptied and put aside. The next panel shows the flexible water pipe at the bottom of the trench. It has been attached to a set of hydrants along the length of the trench. The hydrants are kept in place by 4 x 4 posts. In the panel on the right two conduits have been laid out along the length of the trench above the water pipe. One conduit will carry electricity the other data. The trench is now (mid-Nov) mostly filled in.

contractor in charge of the digging is a fellow named Con who has a glint in his eye and a hint of a brogue. He knows his way around Bobcat excavators. It took 2 days for him to dig a 3 foot deep trench from the 19th St gate to the central lawn. The next day flexible piping with one inch internal diameter was laid out at the bottom of the trench and attached to vertical hydrants held in place by 4 x 4 vertical posts. The piping was filled with water to test for leaks. Everything is water tight. The trench is 3 feet deep to assure that the bottom is below the frostline even during Philadelphia's coldest winters. So the water in the pipes shouldn't freeze. Two conduits will also be placed a little higher in the trench so that an electric line and a data system can also be installed. Afterwards, the trench will be filled with the soil that was dug up but 6 inches lower so a 'geogrid', a honeycomb-shaped material, can be laid down and filled with gravel fines that will allow rainwater to permeate below but will keep out weeds. The process will be repeated for the other three east-west paths.

We will soon have a hydraulic system to rival the ones described above albeit on a much smaller scale. Even a thousand years from now archeologists will marvel at the hydraulics and the tall cast iron fence that protected the water supply system that supported 200 farmers. They will be surprised that this could have all happened without the need for a pharaoh. Oh happy days.

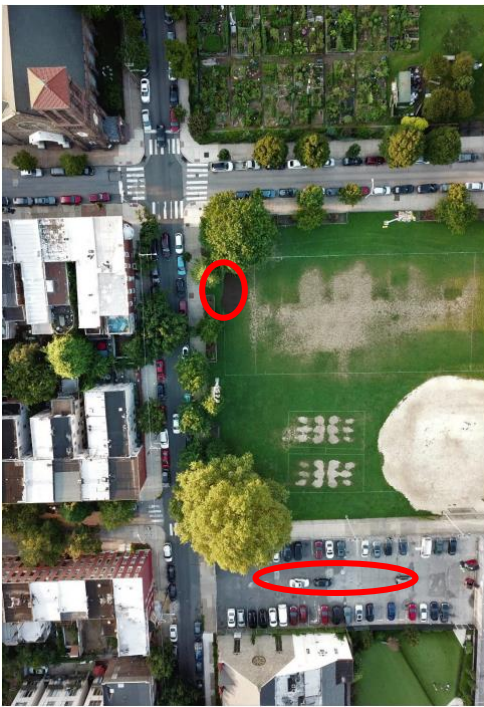
In search of underground stream beds

As we mentioned in earlier issues of Green Thoughts, there are areas of TSG that have visibly subsided. One area is at the southeast corner near 18th and Wallace Streets. Every year more soil must be added to plots over there to replace the ground that has been

eroded from below. There is also a patch of the northwest quadrant of TSG that is slowly sinking. The cause of the sinking begins innocently enough on the highest land in our vicinity - the Francisville recreation area and the surrounding plain to the north of TSG. Rainwater can be absorbed by the local soil. But once the soil is saturated the water has to go somewhere. Up until the 1850s, before the region was developed, there was a creek that flowed southwest from Francisville into the Schuylkill. Once the land was developed for housing and churches and manufacturing the water was no longer free to flow at the surface. Storm sewers carried the water away. Over a 160 year period those underground sewers leaked and water found its own way downhill carving out underground streams. In times of drought the streams possibly dry up. In times of heavy rain the streams could carry significant volumes of water. By looking at the distribution of houses undermined by underground streams in our area (houses with stars on their walls) we can trace the likely paths of several underground streams in our area. If a localized patch of ground over a stream bed is "softer" than adjacent patches it is more likely to turn to mud. Over time the softer patch will be flushed away and the ground above sinks. Our drone photographer, or rather, our photographer who has a drone camera, Nick Gruberg, provided in 2019 aerial views of TSG and adjacent areas. One stream-path appears along a fairly straight north/south line where three areas have visibly sunk: 1) part of the northwest quadrant of TSG, 2) a patch of center field in Roberto Clemente Park and 3) the parking lot to the north of the church. That last area has been neglected for years and the sinking is deep and extensive and could be on the verge of swallowing any cars (continue on p8)



This wonderful aerial view (above) shows the entire 2.6 acre site of The Spring Gardens taken in September 2019. North St. is on top, Wallace St. is below. 19th St. is to the left, 18th St is to the right. The yellow dashed line is along the east/west path where the first trench has been dug. The red ovals crudely demarcate areas of TSG that are sinking. Photo by Nick Gruberg.



To the left is another aerial view showing the southwest part of TSG (above), the western part of Roberto Clemente baseball field (middle) and the parking lot behind Enon Baptist Church (below). 19th St runs from top to bottom. The red ovals outline visibly sinking areas. Photo by Nick Gruberg.

innocently parked in the middle of the sunken area. Once there has been subsidence, sink holes can happen rather suddenly.

We don't know the anatomy of the sunken stream beds that support the underground streams. Are they discrete and narrow or spread out? How deep are they? On November 8, 2021 When the northwest quadrant trench was dug, three feet deep, from the 19th St gate east to the central lawn the trench (see dashed yellow line of photo on page 7) should have passed over and be perpendicular to the stream eroding the patch of land just to the north of the trench. Was there a segment of the trench that gave some sign there was an underground stream below? Perhaps that segment was wetter than adjacent segments?

The answer is that the trench was uniformly dry. It suggests that the underground stream bed is significantly deeper than three feet and doesn't easily reveal its secrets. Con, the man on the Bobcat digging the trench, has experience doing excavations in the area. He thinks that any stream bed is likely to be at least 9 feet down. That is what he found when



he was on a different project digging near Ridge Avenue.

The east/west trench in the northwest quadrant is the first of 4 east/west trenches. We are looking forward to the digging of the trench in the southeast quadrant, especially at its eastern-most terminus near where the sinking is at its worst. Perhaps a hole deeper than 3 feet can be dug near 18th St to reveal what is going on underneath. We'll report in the next issue.

The information will be interesting. But what can we do with that knowledge? Put in an underground deflecting wall to divert the water? That would seem to solve the problem. But there would still be water going downhill. A deflecting wall would simply shift the problem to adjacent areas. A puzzle.

Thanks

To Russ Troyer for information about the hydraulic project.
To Ann Northrup for deconstructing a PDF file so we could use individual aerial photos.

Please send your ideas, thoughts, suggestions and observations to:
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that address can also be used for getting on the mailing list for **Green Thoughts**, or getting off.

Prepared by Ed Gruberg

Most back issues and a partial index of Green Thoughts subjects can be found on The Spring Gardens Website under Resources