Soil Injecting & Drenching Liquid Tree Care Products;

a somewhat uncommon & more detailed analysis of the application techniques that lie at the roots of our trade.

- by Joshua Morgan

Introduction

There is often an integral disconnect between the manufacturers of tree and shrub care products, and the technicians that apply said products for satisfaction on homeowner and commercial properties around the globe. The roots of Organic Approach lie predominantly in service work around Lancaster County, Pennsylvania. Every one of the products that we have developed has been battle tested over decades of trial and error in the field. Due to this, our humble organization is not only capable, but obligated, to share our wealth of applicable knowledge of tree and shrub care with you, our loyal clientele. By generating a collection of available knowledge in the community, we can share our experiences regarding application methods, rates, and quality products to ensure continued efficacy and success in the field. This document is directed toward tree and shrub care technicians across the industry. Whether you are an arborist at an arboretum, a forester in a National Park, a multi-generation tree care company that is well known in your community, or a 20 year old with a pick-up truck just gearing up to hit the road, we hope that you will find some element of this piece helpful to your operation.

First, let's tackle the basics. When it comes to nutrient delivery the two main liquid application methods utilized for feeding trees and shrubs are soil injection and soil drenching. The most common set-up for these application methods is some combination of mobile liquid tank (i.e. spray truck, trailer, etc...), and a pump/motor combo intended to pump pressurized liquid product through a hose to the applicator attachment, most commonly a soil probe or a spray gun. While the technician can sometimes be limited by hose length on a very large property, or by limited access for a large truck in a city or residential environment, this tried and true method works for the majority of commercial and residential property applications.

A backpack soil probe can occasionally be used in place of a hose fed injector probe in situations where the application site is out of the range of larger less mobile equipment, or when larger volumes of tank mix are out of the question. This backpack method is beneficial to have in the arsenal for specific applications. In this same vein, a spray gun attachment is also a good thing to have in a pinch, even if soil injections are your bread and butter. A JD-9 spray gun can come in handy when you're at the end of your hose reel and you have to blast a few more ornamentals as an afterthought, or when you need to complete a foliar drench on a small ornamental tree 25 feet in the air.

As we move forward with our discussion, we will assume we're discussing a transportable liquid storage tank, along with a pressurized application system. Let's now break down the strengths and weaknesses of soil injection vs. soil drenching so we can assess their viability under various parameters.

Soil Injection

The fundamentals of soil injection are fairly basic. Pressurized liquid product is pumped through a hose to the soil injector which is repeatedly introduced to the soil beneath the canopy of the target tree in a radial pattern from the trunk to the dripline. This application method remains one of the preferred industry standards for large trees under normal environmental conditions due to the efficacy of the product delivered to the active root zone. Soil injecting in concentric circles, starting at the root flare, and working away from same, ensures a very thorough coverage of feeder roots and adequate product delivery. Pressurized liquid entering the ground typically results in soil fracturing at an average depth of 4-12 inches, effectively distributing the desired amount of product through an assumed radius approximately 1-2 feet around the point of entry (+/- depending on soil conditions).

Soil injection is one clear option for the majority of large volume tree and shrub fertilizations. The fracturing of the soil in a consistent and uniform pattern ensures adequate root inoculation, pest control and/or soil fertilization within the target treatment zone. Once the technician becomes comfortable with the pressure settings of their system, a wrist watch or portable timer can be used to calculate gallons/minute to ensure minimal waste and maximum efficiency at the desired rate for any given tree or woody landscape arrangement.

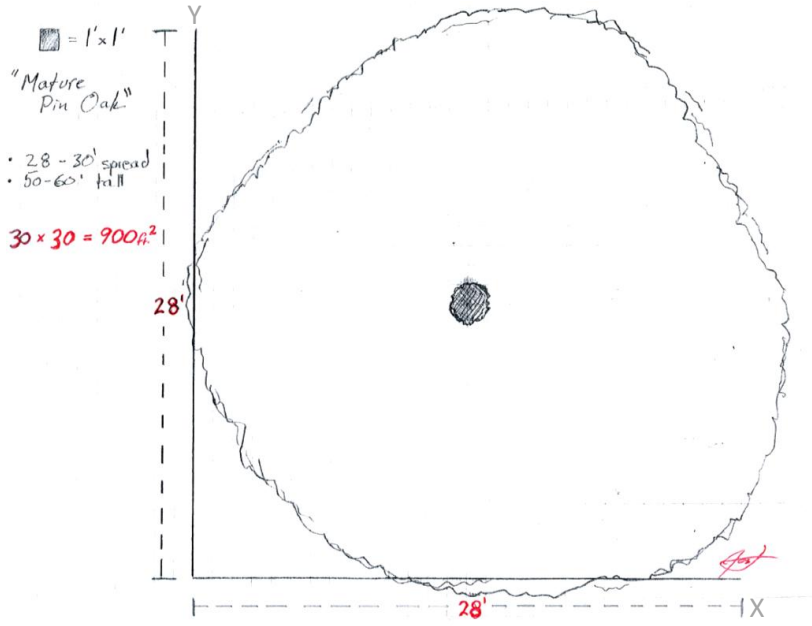
After years of experience, some tree care technicians will develop a style of working that relies more on intuition than hard calculations. At this point the trade becomes equal parts art and science, but this only comes with countless hours in the field and an intimate knowledge of the individual technician's environment. This being the case, I have developed a series of rudimentary hand-drawn diagrams that outline a soil injection application process around a semi-mature Pin Oak, as well as a fictional character by the name of "Doug" that lives over in neighboring York county, PA to help outline how a beginner may approach a soil injection on an unfamiliar property.

Doug has been around trees his whole life. As the son of a forester, Doug has always been an avid outdoorsman. Doug is home from college on summer vacation and needs to pick up some hours so he can afford books for the coming semester. He jumps on the crew of a local tree care company, and after a week of training in the field he finds himself standing alone under a Pin Oak tree somewhere in York County with a soil probe and a lot of questions. Luckily, he did a quick mock soil injection into a large measuring cup/pitcher at the shop before heading to the jobsite, and he was able to discover that his system would output approximately 5 gallons per minute at the current pressure setting. This would be helpful knowledge for Doug later. For now, we are going to retrace Doug's thought process to discover how he came up with his injection pattern for the diagrams to follow, and at what volume.

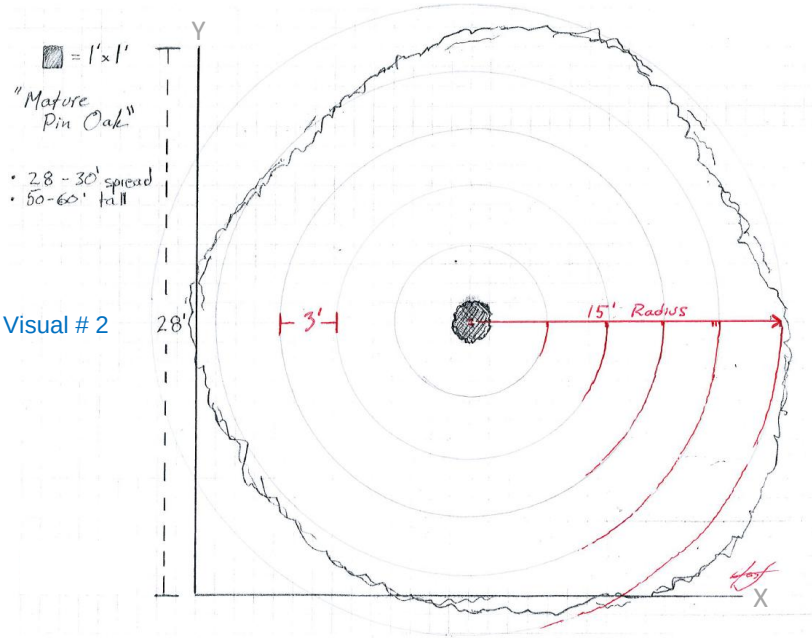
Soil Injection cont'd

Due to Doug's lack of experience in the field his employer has tasked him with some simple fertilization applications to complete on established properties around the county. He also received a "cheat sheet"* to help him determine the volume of pre-mixed liquid fertilizer in his tank to be applied to plantings of various sizes. He paces out the East/West *(X axis)* and North/South *(Y axis)* of the dripline area beneath the Pin Oak seen in the diagram to the right, and Doug rounds up each measurement from 28 feet to 30 to ensure full coverage. Doug determines the square footage of the dripline area/active root zone by multiplying the lengths of the X & Y axes (30 x 30), to be roughly 900 square feet. He also eyeballs the height of the tree at roughly 50 to 60 feet. In studying the "cheat sheet"* for volume rates that his employer gave him, with these parameters in mind, he approximates that this specific application will require approximately 60 gallons of liquid fertilizer mix. *(Reference Visual # 1)*

Visual # 1



Visual # 2



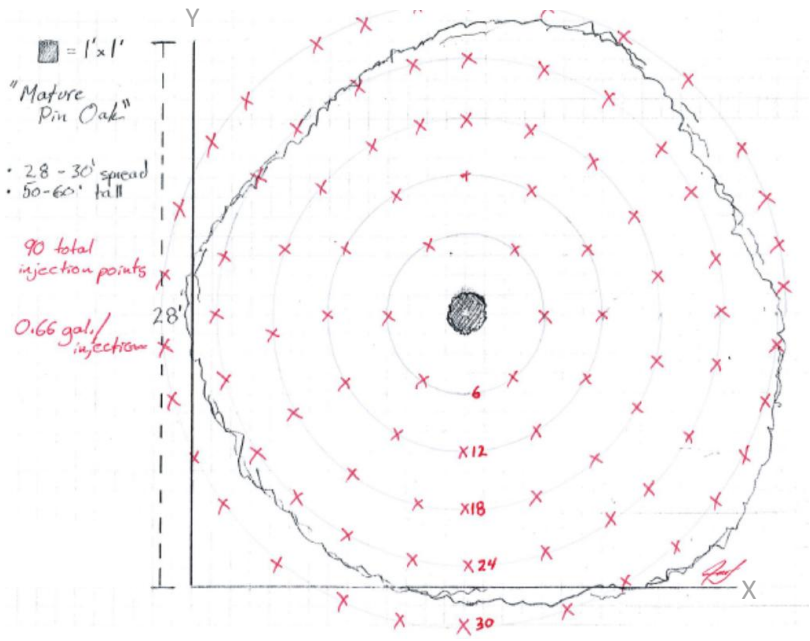
Next, Doug has to rely on his training to figure out the appropriate spacing for his injection points so that he can attain complete coverage over a 900 square foot active root zone with 60 gallons of liquid. If a 3 foot center is desired between injection points, he should divide the 30 foot canopy diameter by 2 to determine the canopy radius of 15 feet. Doug then divides the radius by the intended injection center of 3 feet (15 ÷ 3) to find that he should inject on a pattern of 5 concentric circles, with each next pass around the tree being another yard from the base of the root flare. *(Reference Visual # 2)*

Now that Doug has determined the correct placement of his concentric circles, his next task will be to calculate the quantity of corresponding injection points for each pass around the tree. In order to accomplish this Doug will need to apply some more basic math. The circumference of any true circle is found by multiplying the diameter by Pi, or 3.14. The diameter, (which Doug has already generously

* Cheat Sheet – This is an item that "some" companies will have created over time working in the field. It could include hand written or typed up notes from countless trial and error runs for things such as product usage rates and formulas to use based on tree type, height and canopy circumference.

Soil Injection cont'd

Visual # 3



**The rates outlined in the above example are meant to communicate a general understanding of the soil injection method and should not be assumed as an industry standard. Every technician's tank mix and rates will differ depending on the application and time of year.*

estimated at 30 ft.), can be found, if necessary, by doubling the radius. This is the actual formula for the sake of visualization: $C=2\pi r$. Now this is where the intuition comes in. When Doug overestimated his diameter at 30 ft. he helped himself in two key ways. First, He insured generous coverage of the active root zone by overestimating his square footage and therefore his volume requirement too. Secondly, he gave himself the option to make his math much cleaner. In the field, whole numbers and even numbers are much friendlier to work with, especially when Doug has to run these simple equations in his head without the help of a calculator. Fast math equals fast jobs, and more applications completed in a day. More applications completed in a day equals more revenue for the company, and more satisfied clients! Now Doug rounds Pi from 3.14 down to 3. He knows he can get away with this due to his earlier generosity. By removing these nuisance decimals Doug has inadvertently created a perfectly balanced equation. If he were to start with the largest and most outer circle, he would multiply the diameter (30) by "Pi" (3) to find the circumference at 90 ft. When he divides the circumference (90) by the desired center between injection points (also 3), he discovers that 30 is the required number of injection points for his outermost application ring. This right here is where the intuition and "mad scientist" mentality play into the job. By breaking it all down, Doug realizes that the amount of injection points required for every application circle that he will ever complete on a 3 ft center, agrees with the foot length diameter of the corresponding circle (+/-1).** A 24 ft. diameter circle will require 24 injection points; a 6 ft. diameter circle will require 6 injection points, etc… If Doug halves his injection center to 1.5 ft., his injection points will double. You with me? Good. Now Doug simply adds it all up to find the sum of all combined injection points for the application to be 90. To evenly distribute his 60 gallon volume over 90 injection points, he divides 60 by 90 to find a volume of 0.66 gallons for each individual injection point. *(Reference Visual # 3)*

Since he already knows his pump puts out 5 gallons per minute due to the mock measuring-cup trial that he performed a few paragraphs ago, he can assume 1 gallon of product for every 12 seconds to be a reliable estimate as well. If he only needs 0.66 gallon for each injection point, he can divide 12 *(seconds)* by 0.66 *(gallons)* to find that 8 seconds will be the amount of time he should inject every site to ensure adequate and even coverage of his active root zone for the liquid fertilizer application to the Pin Oak in question. Timing himself with his wrist watch for 8 seconds at each injection point, Doug thoroughly and successfully completes the 60 gallon application, and is on his way to hitting his stride in the tree care industry.

** Josh's 'simplified' formula: (C=3d) [d=diameter]. In the field, time is money.

Soil Injection cont'd

In some situations it may be necessary to tweak application concentrations. If a tree is suffering from compacted soil on only one side and reduced growth is visible in the canopy, a higher concentration of stress reducing fertilizer mix could be applied to the roots on the struggling side. If a row of trees is packed tightly together, it may be acceptable to marginally decrease product application in between the trunks and focus more heavily on the root flare, outside canopy's edge, and coordinating axis. These are the roots systems that will feed apical and outward foliar growth. Often, technicians may find themselves limited by the existence of anthropogenic structures, which is a clever way of saying "sidewalks", or "driveways", etc. In this case a work-around is necessary. Just do your best! In most situations however it is important to keep moving and paint with broad strokes to ensure complete coverage of a target area.

Soil Drenching

Soil drenching is another application method that can be used to achieve desired product delivery in tree and shrub care, although its applications are sometimes more limited and environment specific. An effective soil drench is comparable to watering your plants with a garden hose; in theory, it's pretty straight forward. In practice however, this technique should probably be implemented only when conditions are favorable for this approach. For example, it is important to be aware of runoff in a soil drench situation so that products aren't wasted or staining driveways and sidewalks.

Soil drenching can be highly advantageous in situations where severely compacted soils limit the ease of soil injections. Alternatively, some might argue that soil injecting is required to stimulate a deeper soil/microbial fracturing of compacted soils. It is also possible that a combination of the techniques could be useful, but this is often left up to the judgment of the technician. Anybody that has put a soil injector into rock hard soil for 5 seconds and seen their product immediately come back up like a geyser is familiar with this problem. Of course, there is no "one size fits all" solution, and the applicator must use their understanding of the environment to discern the most appropriate application method for maximum product efficacy. In compacted soils, the majority of small feeder roots that actually participate in nutrient exchange lie closer to the surface of the soil, and this is especially true when compacted soil causes low nutrient density, as well as lower water and oxygen availability at greater depths. In the instance of compacted soil or drought conditions, it is not uncommon to also find bare ground or sparsely rooted grass under the shade of a tree. This is one

Soil Drenching cont'd

situation where a technician may find it appropriate to carry out a soil drench application. With no dense turf under the canopy there won't be significant competition for nutrients, and the gradient of the ground is also more visible to the naked eye. When a significant volume of liquid product is delivered to the surface of the soil surrounding an active root zone via a soil drench, the technician may retain more control of where the liquid goes.

A slightly less common but effective approach is to apply a larger percentage of the product requirement for the entire tree as a soil drench to the area immediately surrounding the root flare. As the volume around the tree sheds from the root flare and percolates into the surrounding soil, some areas will soak up the liquid product more rapidly than others, and the compaction gradient will reveal itself to the naked eye. This can be a useful trick in discerning trouble spots in the overall soil structure which can then be given greater attention via higher product concentration or an additional soil injection application.

Another situation where soil drenching can be particularly beneficial is when a liquid fertilization is required for a large area containing smaller plantings such as a landscape bed of woody ornamentals. If needed, a soil drench can be sometimes completed effectively from a distance with a spray gun without the headache of dragging a heavy hose through a number of sensitive plantings. This application method is almost always a home run as long as there isn't an excessive amount of mulch in the bed that will bind up the products before they reach the active root zone. It is also important to watch out for delicate blossoms and pollinating insects in these situations since these items usually don't respond well to getting blasted with fire hose pressure.

The forest through the trees…

This is by no means a complete guide to tree and shrub care, but rather a general set of guidelines and ideas meant to contribute to the ever growing wealth of knowledge that exists in the tree and shrub care community. Ultimately, the various territories across our nation encompass such a vast and diverse set of environments that each of us is forced to become an expert, or at least a mad scientist, in our own communities. Client properties differ vastly in their requirements, and only time spent gaining hands-on experience in the trees will reveal all of the tips and tricks of the trade. That said, as long as you don't splatter the homeowners brand new white siding or walkways with black humate and seaweed extracts, or spray their dog with Imidacloprid, you'll be well on your way. Even if some humate does make it onto the walkway, we've still got you covered. Our company has created our own line of "Judson's" soap specifically formulated to help our clients clean up in case of those "oops" moments. As always, we at Organic Approach appreciate your business. Feel free to drop us a line (717-299-2112) or email (info@organicapproach.com) with any questions, and good luck in all of your endeavors.

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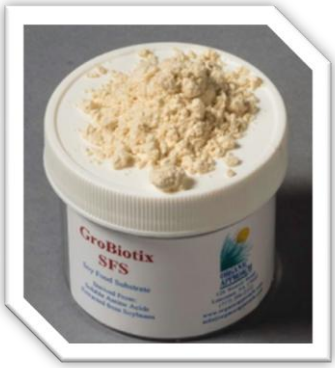

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