

Effects of Humate and Organic Based Soil Treatments on Urban Soil Characteristics

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Table of Contents

Introduction.....	2
Literature review.....	4
Research design and methods.....	4
Implications and contributions to knowledge.....	6
Reference list.....	Error! Bookmark not defined.
Research schedule.....	6

Introduction

Urban soils have long plagued tree care providers with a difficult obstacle to tree health optimization. The very nature of how our urban soils come to be makes it quite challenging to diagnose the major issues with our soils, let alone correct those issues consistently, and with enough efficiency to make it affordable to clients.

When buildings or homes are built in our cities and towns, the natural layout and structure of soils is heavily modified, and often changed in erratic ways. Large holes are dug, bringing soil horizons meant for the deep areas, to the surface; mixing heavily with surface horizons. The top O and A soil horizons are often scraped clean to level surfaces, moving them or completely taking them away. Outside products, like “clean-fill” are often brought in, adding foreign soil or even rock (like quarry, limestone fill) into the surface soil area.

On top of this sub-par growing medium we’ve created, we also plant turf or put asphalt and concrete into most of the area. We then rake up and get rid of all organic litter and material, continually robbing the soil of the reincorporation of organic matter that forests are accustomed to. To add to the problem, urban trees are grown quickly using synthetic fertilizers on tree farms, and then dug up to be planted, cutting anywhere between 50-90% of their roots off, and often planted in different soil than they were grown in.

This entire predicament creates poor chemical, physical, and biological soil characteristics, resulting in poor urban tree growth, increased insect and disease populations, and high rates of nutrient deficiencies.

The options for remedying some of these issues include synthetic fertilizers, organic fertilizers, nutrient injections, Airspading, etc. The standard practice for decades has been to use synthetic fertilizers that have specific ratios based on your area of the country. This however, does not address the underlying issues associated with the soil itself, instead attempting to address solely the deficiencies within the tree, often without success due to the variability of soil and nutrient deficiencies, as well as problems that synthetic fertilizers simply cannot correct. In recent years, as technology and organic products have improved this has spurred a movement back to more organic based treatment plans in an attempt balance the soil characteristics naturally and help fix the underlying issues that plague urban trees.

The main problem is that the term “organic matter” can mean a host of different things and includes organic products that may or may not do anything in the soil, and historically can be very inconsistent. As companies have improved the products on the market and become more specified in what constitutes an organic soil fertilizer, the success rate has also increased. A shift towards consistently made, high concentration humate based fertilizers, as well as research backed bio-stimulants has opened the door to allowing organic fertilizers to not only be more successful but achieve things that synthetic fertilizers simply cannot do.

The main goal of this research is to understand what effect humate based organic fertilizers, bio-stimulants, and traditional NPK fertilizers have on all characteristics of urban soil and the nutritional health of trees growing in that soil.

Literature review

There are a myriad of studies and papers written on the topic of synthetic fertilizers and their efficacy for certain things, as well as their detriment when used improperly. An example is Dr. Dan Herm's 2006 paper, "Effects of Fertilization on Insect Resistance of Woody Ornamental Plants: Reassessing an Entrenched Paradigm", discusses the misuse of synthetic fertilizers and their propensity to decrease pest resistance in trees as a result of that misuse.

Clemson University and Cornell University both advocate for proper use of synthetic fertilizers, only applying what is needed, at the right time, based off testing. On a 2004 factsheet about tree and shrub fertilization listed on the webpage for Clemson's School of Environmental Sciences and Forestry, they say:

"Fertilizer should not be considered a cure for ailing plants when un-adapted or unhealthy plants are chosen, carelessly planted or improperly watered.

When fertilizing trees and shrubs, keep these two points in mind: (1) Fertilizer is beneficial when it is needed; but (2) Use it in the right amount, at the right time and in the right place."

Unfortunately, there is not a large set of research involving the use of organic products specifically in the urban area on urban trees, which is one of the reasons I wanted to conduct his research. There is plenty of information however, on what organic matter and humates can do for soil characteristics. That information, combined with newer age, quality humate products is what forms the foundation of this research for urban trees.

We hope to show the full spectrum of what effect humates can have on our urban soils, and how that translates to our urban trees.

Research Design

This research is going to be broken into 2 different research sites.

Site 1:

Location is at Joseph Tree in Dublin, OH. This is going to be a soil ONLY research site. The soil on site is very similar to the soils we encounter on a daily basis for tree care clients. The site is a lawn/turf area that has had only turf on it for at least the last 8 years. This location will have 3 separate, but identically tested and treated plots.

Each plot will have 7 test points. Each test point will receive a different treatment type, and will be analysed the same as all other test points. Each soil test point will be a 6x6ft square.

The treatment types are as follows:

- 1.) Control
- 2.) Vital Blend – R (4oz. per 1gal water) + AgX Biostimulant (15ml per 1 gal water)
- 3.) Vital Blend – M (1.5oz. per 1gal water) + AgX Biostimulant (15ml per 1 gal water)
- 4.) Vital Blend – R (4oz. per 1gal water)

- 5.) Vital Blend – M (1.5oz. per 1gal water)
- 6.) NPK-S Fertilizer (20-4-10-15S) at 0.15lbs per 1 gal water
- 7.) NPK-S + Vital Blend-R + AgX Biostimulant

Site 2:

Location is on a condo association property that Joseph Tree manages all trees on site. This site will include both trees and soil. Soil will be sampled directly around the tree outside of the mulch ring, but not beyond the drip line of the tree. There will only be 2 total plots on site, and each plot will have 5 test trees. Each test tree will receive a different treatment type and will be tested and analysed identically.

Test treatments as follows:

- 1.) Control
- 2.) Vital Blend – R + AgX Biostimulant
- 3.) Vital Blend – M + AgX Biostimulant
- 4.) NPK-S (50% rate)
- 5.) NPK-S (50% rate) + Vital Blend – R + AgX Biostimulant

Vital Blend 5M is a humate based organic fertilizer that is mixed with 5 micron Biochar in a liquid concentrate made by American Biochar Company. AgX Biostimulant is a kelp based microbial biostimulant sold made by American Biochar Company. The 20-4-10-15S NPK fertilizer is GeoGreen Southwest blend made by GeoGreen Products, and sold by Rainbow Ecoscience.

Methods

Sampling Methods:

All soil sampling will be done with a soil knife. General sampling technique is to cut a small hole in the turf, removing the first 2-3in of turf and turf roots. All sampling will be done at a depth of 4-6” where the majority of fine tree roots occur. Sampling will be random, with 8-10 sampling holes taken per test point. Soil sampling bags from Spectrum Analytics will be filled to a specified line and marked accordingly.

Soil samples for the MicroBIOMeter testing will be taken in the same sampling holes used for Spectrum Analytics according to MicroBIOMeter’s instructions for sampling.

MicroBIOMeter testing will take place at Joseph Tree.

All foliar samples will be at random, and mixture of young and old leaves from around the lower canopy of the tree. A 1 gallon bag will be filled from each tree for each test. A sap analysis will also be done using a random sampling from each tree.

Soil Analysis Testing Metrics:

The following metrics will be analysed for each and every soil sample taken, by Spectrum Analytics in Washington Courthouse, OH.

- All primary, secondary, and micronutrients (excluding Nitrogen)
- Organic Matter(combustion)
- pH and CEC
- Soluble Salts
- SOLVITA soil respiration test
- Bulk Density
- C:N Ratio (only on control and full treatment plot)
- MicroBIOMeter test (This test will be done in accordance with MicroBIOMeter's instructions, done by the same person, in the same location, with the same phone for sake of consistency in testing. This test will yield microbial biomass and F:B ratio)

Foliar Analysis Testing Metrics:

All foliar samples will be analysed for all primary, secondary, and micro nutrients.

Implications and contributions to knowledge

With this research, we hope to show exactly what is happening in our soils and our trees in the urban area when fertilizers are applied. Urban soils have long plagued our landscape trees and with mounting research showing that blanket fertilization using synthetic fertilizers often does more harm than good, we instead turn to organic matter based products in an attempt to bring back balance and optimization to our urban soils that we simply do not have currently. Using the most modern humate based organic fertilizers, biochar, and bio stimulants, we hope to show on paper the positive impact these products can have on the physical, chemical, and biological properties of our soils, as well as the improved health for our trees.

Research schedule

Research phase	Objectives	Deadline
Baseline Soil Tests	Dormant soil test pre spring flush	March 23rd
Pre-Treatment Tests	Testing of all soil and foliage after leaf out, but before treatment	April 27th
Post Treatment 1 st Test	Evaluation of soil and foliage post treatment	June 22nd
Post Treatment 2 nd Test	Evaluation of soil and foliage post treatment, pre fall color	September 21st