Sustainable Procurement for Healthy Soils in Vancouver

Testing Compost Tea and Green Fertilizers

Vancouver Board of Parks and Recreation | City of Vancouver

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Greenest City Scholar: Emme Ann Lee

School of Community and
Regional Planning

University of British Columbia

Conducted for:

Jeff Maclean, Supervisor of Golf Operations

Vancouver Board of Parks and Recreation

City of Vancouver

Phone: 604.718.6533

Conducted by:

Emme Lee

School of Community and Regional Planning

University of British Columbia

Email: writetoemme@alumni.ubc.ca

Phone: 778.882.7472

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SUSTAINABLE PROCUREMENT AS A CITY-WIDE CORPORATE INITIATIVE

Every purchasing decision we make has an impact – on the environment, the economy, and on society. As such, sustainable procurement has, in recent years, become an important area of focus for both public and private sector organizations alike.[1] Procuring goods and services ethically and sustainably can enable organizations, including local governments and other public institutions, to take meaningful responsibility of public spending, while demonstrating genuine leadership in the community, and moving towards achieving sustainability goals.[2]

> *Sustainable procurement means making sure that the products and services an organization buys achieves value for money, and generates benefits not only for the organization, but also for the environment, society, and the economy. Sustainable purchasing ensures that purchases made by an organization reflect broader goals that could be linked to resource efficiency, climate change, social responsibility, economic resiliency, and the like.* *(ICLEI Europe)*

For the City of Vancouver, sustainable procurement relevant to city operations stems from the *Greenest City 2020 Action Plan*, first released in 2011. The City's intentions were clearly stated:

"The City will need to lead the way in its own operations, demonstrating what a Greenest City looks like in City-run buildings, facilities, and operations."[3]

In the year following, the City committed to developing an organization-wide *Green Operations Plan* to cover all major departments. As part of this plan, the City updated a pre-existing *Ethical Purchasing Policy* to include both ethical and sustainability considerations in the procurement process.[4]

The updated corporate procurement policy (2012) embeds both sustainable and ethical considerations into the procurement process, addressing key issues such as greenhouse gas reduction, waste and packaging reduction, toxin reduction, and socio-economic sustainability. The policy specifies the process for procuring sustainable products and services, and makes its

[1] ICLEI Europe, Sustainable Economy & Procurement, 2010-15.
[2] Sustainable Purchasing Leadership Council, Guidance for Leadership in Sustainable Purchasing, 2015.
[3] City of Vancouver, Greenest City Action Plan, 2011, p.6.
[4] Vancouver Board of Parks and Recreation, 2013-2016 Green Operations Dept. Action Plan, 2013.

intentions clear: *"The City wishes to purchase products and services that have positive environmental and social attributes."*[5]

Those intentions and policies most certainly apply to all purchases in major departments, including all products and services acquired by the Vancouver Park Board.

VANCOUVER BOARD OF PARKS AND RECREATION

The Vancouver Park Board plays an important role in helping the City achieve its sustainability goals, and this includes the "greening" of Park Board operations through sustainable procurement, and other means.

As part of the organization-wide *Green Operations Plan* conducted by the City, Vancouver Park Board developed the *2013-2016 Green Operations Departmental Action Plan*. The *DAP* identified 6 quick start actions, including #5 – Healthy Ecosystems, the goal of which is to:

"Identify 5-10 high volume/high value/high impact goods procured by operations staff, and develop a list of feasible alternatives that are more environmentally and/or socially responsible."[6]

As part of completing this action, the Park Board operations group conducted a sustainable procurement project in 2014. The purpose of this project was twofold, firstly, to uncover the most significant negative ecological impacts related to operations practices, and secondly, to develop some alternative practices and processes in response. Several actions emerged as high priorities, one of which was to trial more environmentally sound products to test their efficacy, and determine feasibility for use in Park Board operations.

The first round of testing for more environmentally sound products testing their efficacy and potential for use in operations was completed in Summer 2015. The details of this project are found in the remainder of this research document.

This particular research project was conducted in partnership with the UBC Sustainability Initiative, as part of the Greenest City Scholars program. Sustainable product trials, and other green operations research projects can be exceptionally well suited for graduate-level students with a science-based background, access to a laboratory (if needed), and an interest in sustainable operations.

[5] City of Vancouver, Sustainable purchasing, 2012.
[6] Vancouver Board of Parks and Recreation, 2013-2016 Green Operations Dept. Action Plan, 2013, p.2.

PURPOSE OF THE RESEARCH

The purpose of this research project was to describe two product-testing trials to determine product effectiveness for use in Park Board operations. The products chosen for testing were deemed to be more environmentally and/or socially responsible than products used in park operations, at the time of testing, for equivalent purposes.

Section 1

Describes the testing of compost tea spray on golf greens with the aim of reducing overall fungicide required for maintaining high-quality golf greens.

Section 2

Describes the testing of a selection of “green” fertilizers on a sports field with the aim of reducing overall fertilization required for maintenance of high-quality sports fields.

SECTION 1: THE RESEARCH BEHIND COMPOST TEA SPRAY

ENHANCING SUSTAINABILITY THROUGH PROCUREMENT

Each year the Park Board purchases a wide variety of goods and services for the maintenance of greens (or turf) on Park Board-operated golf courses. In terms of keeping within the interests of sustainable procurement, **a significant opportunity lies in reducing the amount of fungicides purchased for treating and preventing turf disease on golf greens**.

In terms of overall sustainable practices, it should be noted that all 3 Park Board-operated golf courses are Audubon Cooperative Sanctuary certified. Certification renewal occurs every two years. Attaining, and maintaining certification requires that golf courses implement, document, and maintain environmental management practices in the following areas: environmental planning, wildlife and habitat management, chemical use reduction and safety, water conservation, water quality management, and outreach and education. Audubon certification requirements are designed to ensure the enhancement of existing natural habitats and landscaping to promote wildlife and biodiversity conservation through environmental planning, reduced environmental contamination, best management practices, integrated pest management techniques, and education.[7]

Additionally, for over two decades, the Park Board has been actively using Integrated Pest Management (IPM) practices to address insects, weeds, and disease pressure in park operations. An IPM Coordinator provides guidance on a variety of cultural, biological and mechanical methods for managing pest issues, which has resulted in minimal reliance on chemicals for pest control.[8]

The Audubon certification, and the municipal-level IPM policy help to ensure that the Park Board adheres to the highest levels of standards that exist industry-wide for golf course sustainability.

THE ISSUE OF DISEASE ON GOLF COURSE GREENS

Turf diseases are a serious matter for golf course superintendents. Disease can impact golf courses in any season, as well as the aesthetic and functional quality of the greens if left uncontrolled.[9] Diseases are easily spread via wind, water, machinery, and foot traffic.[10]

[7] Audubon International, Environmental Management Practices for Golf Courses Fact Sheet, n.d.
[8] Vancouver Board of Parks and Recreation, 2013-2016 Green Operations Dept. Action Plan, 2013, p.10.
[9] Mattox et al., Research Update: Effects (Hsiang) of Alternatives to Traditional Fungicides and Winter Fertilization Practices on Microdochium Patch, 2014.
[10] Hsiang, T., University of Guelph. All you ever wanted to know about Fusarium Patch, 2007.

Two of the most commonly observed diseases at Fraserview Golf Course are caused by fungi: (1) microdochium patch (Microdochium nivale), sometimes known as fusarium patch, pink snow mould, or microdochium patch; and (2) anthracnose (Colletotrichum cereale). Both of these diseases are common to the Metro Vancouver area. These diseases commonly afflict turf grass particularly because of the stressful conditions that turf grass is constantly exposed to under conventional cultivation.

Microdochium patch / Microdochium nivale
Photo: MSU Plant Pathology, 2015

Anthracnose / Colletotrichum cereale
Photo: MSU Plant Pathology, 2015

THE USE OF FUNGICIDES

The typical treatment for a fungal disease affecting turf grass is with a pesticide, or more specifically, a fungicide. Since the use of pesticides can have harmful environmental and biological effects, their use is highly regulated.

Under federal legislation, all pesticides (including herbicides, fungicides, and insecticides) in Canada must be registered by Health Canada. Through the *Integrated Pest Management Act and Regulations*, provincial legislation regulates various pesticide-related activities, including its sale, containment, preparation, mixing, application, and disposal. The Act also requires certain pesticide applicators to be properly certified.[11]

Within BC, municipalities can pass local by-laws that restrict cosmetic pesticide use; however, they do not have control over the sale of pesticides, or its use on non-residential private property. Municipalities do not have the power to ban pesticide use and sale entirely, but they can ban its use on private residential and municipal lands.[12]

[11] BC Ministry of Agriculture, Pesticide Laws and Regulations, 2014.
[12] Foster et al., BC Atlas of Wellness, 2nd Edition – Pesticide-free communities, 2011, p.124.

Since 2006, Vancouver has had a by-law banning the use of pesticides, currently under *Health By-Law No. 9535*.[13] In Vancouver, all neighbourhood parks, sports fields, and playgrounds are completely pesticide-free.[14] Public golf courses are one exception to the otherwise pesticide-free park spaces. In order to use a pesticide, all purchases are registered and approved through the office of the Integrated Pest Management Coordinator. All pesticide applications are made by certified pesticide applicators only.

A special note on neonicotinoid pesticides, which are largely known for their impacts on pollinator populations – Vancouver Park Board does not use any neonicotinoid pesticides. Additionally, as of October 2014, Park Board stopped all purchases of plant products treated with this class of pesticides.[15]

The opportunity for enhancing sustainable practices for the maintenance of golf greens lies in reducing the amount of fungicides currently used for treating and preventing turf disease on golf greens.

WHAT CAN COMPOST TEA DO?

According to a preliminary review of the scientific literature, compost tea is not likely to replace the use of fungicides for disease treatment and prevention on golf greens. However, **the use of compost tea can provide benefits to plants contributing to disease resistance, and a reduced use of fungicides.**

The theory (and hope) behind compost tea spray is that regular compost tea application will increase soil microorganism and nutrient levels to such a degree as to reduce disease frequency and severity.[16] However, a scan of the academic literature for compost tea as a disease suppressant has turned up surprisingly little. For all of the many websites and articles touting the benefits of compost tea, there are very few published scientific papers – which is not to say that this topic isn't being studied – simply that papers are not being published in scientific journals. The literature scan did reveal a number of university webpages showing current, or past (in the last 15 years or so) research on the topic, and numerous references in popular magazines, such as *Biocycle*, and various landscaping and turf industry journals.[17]

One such article that appeared in *Biocycle* in the early 2000s reported on a university research group where they conducted a 12-month compost tea study at Presidio Golf Course in San

[13] City of Vancouver, Health By-law 9535, 2007.
[14] City of Vancouver, Integrated Pest Management policy, 2012.
[15] Shore, R., Vancouver park board institutes pesticide ban to help save honeybees, Vancouver Sun, 2014.
[16] Biocycle, Effects of compost tea on golf course greens, 2002.
[17] Linda Chalker-Scott, The Myth of Compost Tea, Episode III: "Aerobically-brewed compost tea suppresses disease", 2005.

Francisco, California.[18] Their research reported reduced severity of Microdochium patch, one of the same foliar turf diseases commonly afflicting the greens at Fraserview. However, no academic report was published to substantiate the study.

Researchers at Oregon State University published a research update on a very recent study (2013-14) on the Western Canada Turfgrass Association's website.[19] Their trials include the use of a product that aims to activate the grasses natural defenses, thus preventing disease for taking hold in the first place.[20] In promoting plant resilience to disease, the mechanism for how the product being tested works is similar to how compost tea is proposed to work; however, the characterization of the product remains undisclosed so a direct comparison to compost tea spray can not be made.

Additionally, anecdotal evidence has come from a golf course located in a neighbouring municipality to Fraserview. The golf course superintendent there has reported up to a 75% reduction in the use of fungicides. Groundskeepers have been spraying compost tea on a regular basis since 2013, and plan to continue this practice into the foreseeable future.

Evidence for the effectiveness of compost tea as a disease suppressant is lacking. Even so, finding alternatives to fungicides is becoming ever more crucial considering that the increasing pesticide bans and restrictions in recent years will severely limit the chemical options available for treating turf diseases. At this point, testing compost tea, and other fungicide alternatives continues to be worth further study.

Soil Core Sampling Equipment
Fraserview 2015

Compost Tea Brewing Equipment
Fraserview 2015

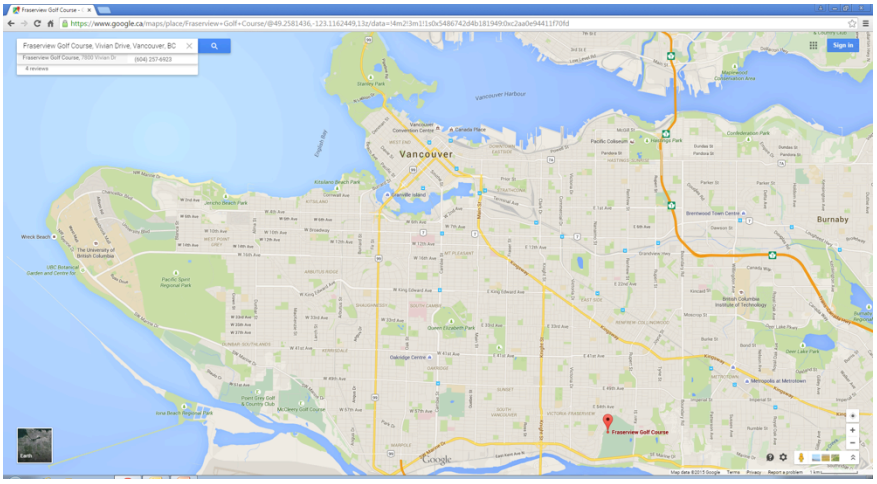
[18] Biocycle, Effects of compost tea on golf course greens, 2002.
[19] Mattox et al., Research Update: Effects of Alternatives on Microdochium Patch, 2014.
[20] Suncor Energy Ing., How does Civitas work?, 2014.

TESTING COMPOST TEA AT FRASERVIEW GOLF

INTRODUCTION

This study hypothesized that **there may be a relationship between the use of compost tea spray on golf greens, and disease suppression**.

Fraserview Golf Course was selected as the site for testing compost tea because of site availability and suitability, and the willingness and ability of staff to accommodate the testing. Fraserview is considered one of Vancouver's top-ranking public golf courses.[21] It is also frequently listed (in the American Registry) as one of Metro Vancouver's busiest golf courses.[22] The course is located in the SE corner of Vancouver, and consists of 225 acres of rolling hills, urban forest, a one and a half acre pond, large stream openings to Vivian Creek, and views overlooking the Fraser River. It is known for its natural beauty, and high quality playing areas.



Fraserview Golf Course is located in SE Vancouver
Image: Google Maps

Fraserview Golf Course, Green #16
Photo: City of Vancouver

[21] VancouverBC.com, Top 10 Golf Courses, 2011.

[22] American Registry, Busiest Public Golf Courses in Metro Vancouver, 2010, 2011, 2012, 2014.

Fraserview Golf Course, pond near Green #13
Photo: City of Vancouver

Horticulture beds near the clubhouse, forage for pollinators

Edible garden beds – growing food for use in the clubhouse kitchen

Fraserview Golf Course Map
Image: City of Vancouver

Fraserview – a forested urban oasis.
An example of Fraserview's many tall trees.

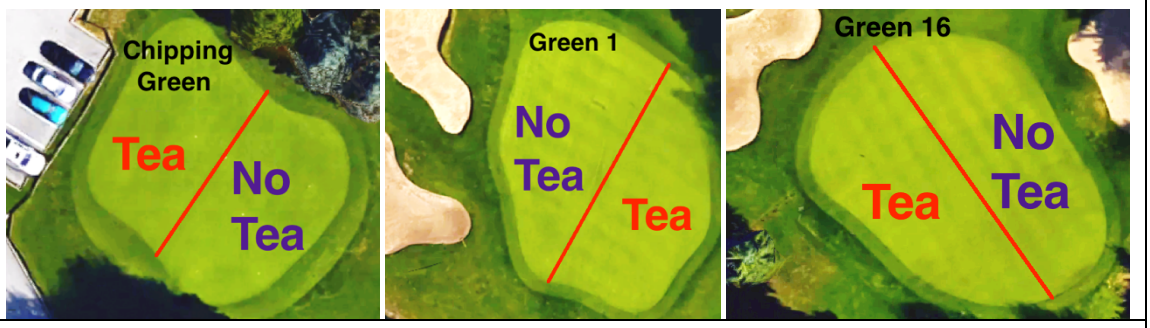
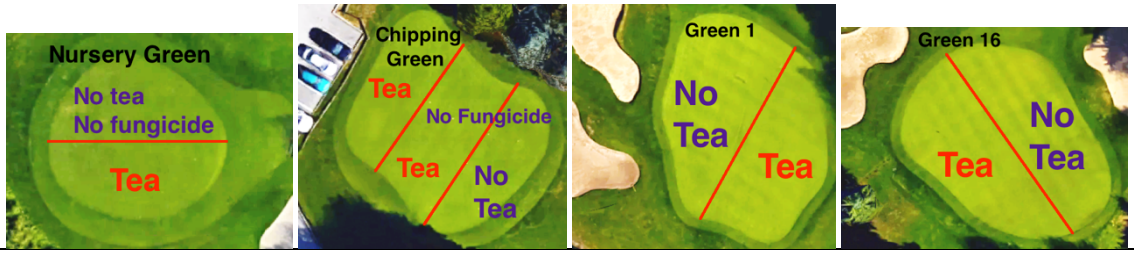
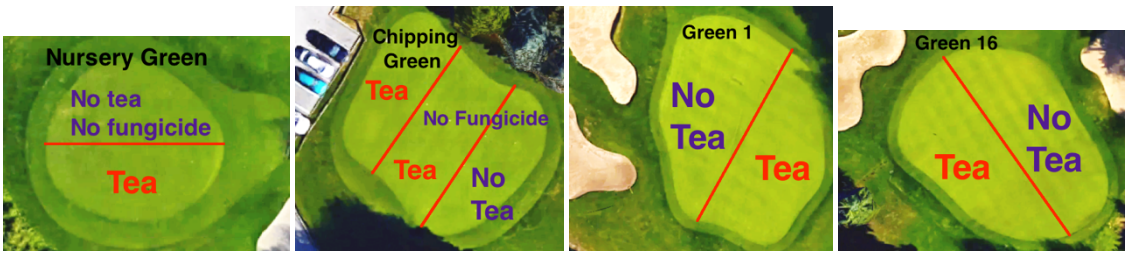
Fraserview's 1.5 acre pond that receives stormwater from nearby streets. Sometimes the water is used for irrigation.

Maintaining high aesthetic and functional quality of the entire course is always of prime importance to Park Board staff, and managers. For the testing period, it was important that regular maintenance of the greens (including the application of fungicides for disease prevention and treatment) continue as usual, while still allowing for adequate testing of the compost tea spray. Completely withholding fungicide application on the regular playing greens (Greens #1 – 18) was considered too risky in the middle of the high season, in terms of playing quality, revenue generation, and course reputation. Without fungicide, there would be too much risk for severe disease damage, and the accompanying impacts of uncontrolled disease.

As such, a research method was designed which allowed for the application of both fungicide and compost tea spray, on complementary cycles. Compost tea brewing equipment was procured as early as possible to allow maximum time for testing the product. A spray schedule was devised, and locations were selected. Compost tea was applied to all greens, with some exceptions. Note that the only locations where fungicide could be completely withheld were the nursery green, and chipping green – they are considered lower priority in terms of quality, acting mainly as practice greens. Greens 1 and 16 were selected for half-by-half comparisons where only one side was to receive compost tea spray, but both sides would receive the usual fungicide application. All other cultivation practices (Eg. Verti-cutting, aeration, irrigation, rolling etc.) were performed uniformly, and regularly on all greens.

The compost tea spray was applied according to the following schedule:

Table 1: Compost Tea Spray Schedule

Date	Spray Locations
May 27	All greens were sprayed with compost tea, with the following exceptions: 
June 23	All greens were sprayed with compost tea, with the following exceptions: 
July 21	All greens were sprayed with compost tea, with the following exceptions:  (Same treatment as June 23)

Note: The application of fungicides continued on all greens when it was deemed necessary by the superintendent. After the May 27th date, it was determined that there should be spray areas where no fungicides would be applied at all. Completely withholding fungicides on regular playing greens was determined to be too risky. Hence, the addition of the nursery green as a test site, and the additional split in the chipping green for the June and July rounds of spraying.

It should also be noted that 2 months is an unusually short time frame for conducting a product trial; a year-long testing period would be more ideal. The results presented following indicate the need for further testing, and a longer trial period for future testing. The compost tea vendor, and others familiar with the product advised that results from compost tea application would not be

observable immediately, but are more likely to be noticed after 4-5 applications. This research reports results after only 2-3 applications.

METHODOLOGY

(1) Determine areas to be sprayed, and not sprayed with tea.
(2) Take soil core samples – the "before" samples. Wash roots and weigh.
(3) Apply compost tea spray according to manufacturer instructions as many times as can be included in the compost tea spray schedule. Consider fungicide applications, and compost tea manufacturer specifications in the timing of the application. Also consider weather conditions, and operational capacity.
(4) Maintain greens according to normal practices. Be sure to treat controls and test areas according to the study requirements. Otherwise, maintain the same practices on all green areas. This includes cutting, rolling, irrigation, and application of fungicides.
(5) Take soil samples – the "after" samples. Wash roots and weigh.

Soil Core Samples from a Golf Green

Soil Core Sample

Washed Roots

RESULTS – DISEASE PRESENCE & ROOT MASS

In terms of testing the effects of compost tea spray on golf greens, it was determined that the main indicators would be (1) Disease presence, (2) Root mass, and (3) General observations in regards to quality of the greens.

(1) Disease Presence

The following is a table showing the disease presence by month for the years 2012-15. Data was taken from an informal logbook kept by the superintendent. Notations of disease are made in the logbook when disease is noticed on any of the greens, but as the logbook is an informal notation tool, data may not always be accurate. The data shows when disease was noted as present by month only; the severity of the disease is not shown as this data is not collected.

Table 2: Disease Presence by Month (2012-15)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	Mp	Mp		Mp	Mp	Mp	At	At	Mp At	At	Mp	
2013		Mp		Mp	Mp	Mp		At	At	Mp At	Mp At	Mp
2014	Mp At		Mp	Mp At	Mp	Mp At	At	At	Mp At	Mp At	At	Mp
2015	Mp At		Mp	Mp			At	--	--	--	--	--

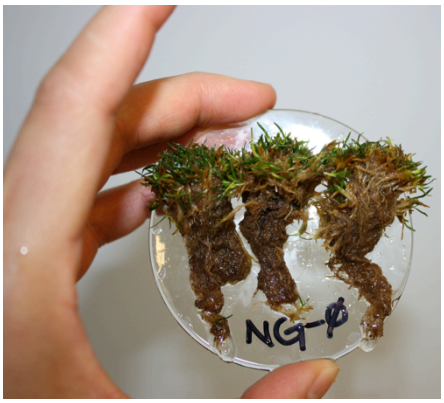
Mp = Microdochium patch **At = Anthracnose**

(2) Root Mass

Soil core samples were taken from each section of the test sites at the start of the trial (May), and then again towards the end (August). The following table shows the mass of the roots after core samples were collected, washed, and oven-dried (at 80°C). After thoroughly washing, sieving, and decanting the core samples, ideally only grass roots should remain. The root material was then oven-dried to remove any remaining water. Finally, the mass of the root material was measured with an analytical lab scale.

Washing and Sieving

Decanting



Washed Roots Before Drying

Table 3: Root Mass – "Before" and "After" Compost Tea Applications

Sample	"Before" – June 2015		"After" – August 2015		Expected	Actual Results
	Mass (g)	% of sample	Mass (g)	% of sample		
NG – no tea/F	4.2126	5.94	6.033	8.04	Difference in % change should be greater in NG – tea than in NG – no tea/F	NG-tea roots actually shrunk considerably compared to the NG-no tea/F. Unexpected. No explanation.
NG – tea	4.5772	7.48	3.4203	4.52		
CG – no tea/F	3.0835	7.13	2.5866	2.51	CG – no tea/F should have the lowest or most negative root mass increase. Difference in % change should be greater in CG – only tea and CG – tea & F	CG-no tea/F roots possibly shrunk compared to before. Unclear due to inconsistent sampling. Greatest increase in root mass in CG-only tea. No increase in CG-tea & F – no explanation for this.
CG – only tea			7.0569	7.60		
CG – tea & F	0.9789	1.70	3.2622	3.37		
G1 – no tea	1.3409	1.84	3.6035	3.89	Difference in % change should be greater in G1 – tea & F than in G1 – no tea	Difference in % change is actually very similar. No clear explanation.
G1 – tea & F	1.1978	2.05	3.7313	3.84		
G16 – no tea	5.7485	9.10	5.8933	5.77	Difference in % change should be greater in G16 – tea & F than in G16 – no tea	Difference in % change is greater in G16 – tea & F. However, this is the only root mass test result that supports the hypothesis that compost tea might lead to stronger plant growth.
G16 – tea & F	4.8842	6.75	11.8202	13.50		

DISCUSSION

From Table 2, it can be seen that Microdochium patch typically shows in the wet months, whereas Anthracnose is more common in the drier months. However, there are anomalous months where Anthracnose appears in a wet month.

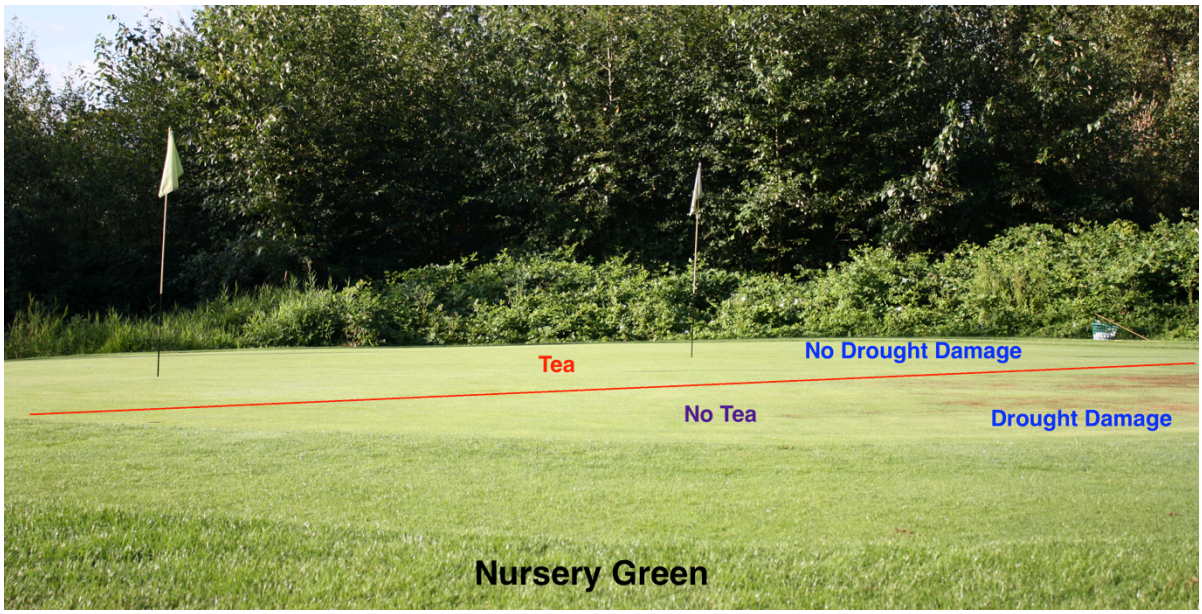
Microdochium patch consistently shows presence in the months of May and June for 3 years prior (2012-14) to the test year. For 2015, April is the last month where Microdochium patch was seen before summer. The absence of Microdochium patch in May and June of 2015 is not likely to be attributed to the use of compost tea spray since benefits of compost tea application are not likely observable until after 4-5 applications. The absence of Mp in May and June is more likely due to the unusual lack of precipitation experienced in these months. The late spring and summer seasons of 2015 were unusually warm and dry compared to previous years.

From Table 3, it should be noted that results are inconclusive. The original hypothesis stating that there may be a relationship between the use of compost tea spray, and disease suppression goes unproven based on these few results. However, it would be worth running the test for a longer

period of time – at least to include a time frame that allows for 4-5 applications of the spray. Time, capacity, and resources permitting, it would be worthwhile for staff to continue the use of compost tea spray for at least one calendar year, considering that the equipment and a portion of the material purchases have already been made.

ADDITIONAL OBSERVATION – POTENTIAL PREVENTION OF DROUGHT DAMAGE

Toward the end of the testing period, staff members made a significant observation: the nursery green showed drought tolerance in the portion of the green treated with compost tea. Staff reported that the nursery green consistently shows drought damage in summer; however, this summer, there seemed to be a distinct reduction in the amount of drought damage appearing on the nursery green. These images indicate where drought damage occurred during the trial, and where it would normally appear (but hadn't during the trial). Since the drought tolerance appeared only in the half of the green where the compost tea had been applied, it may be safe to conclude that the compost tea may have helped in preventing drought damage.



CONCLUDING REMARKS

This study hypothesized that **there may be a relationship between the use of compost tea spray on golf greens, and disease suppression**. The results for this test were mostly inconclusive; however, running the test for a longer period of time (to include a time frame that allows for 4-5 applications of compost tea spray) is highly recommended.

The most significant piece of evidence supporting the beneficial use of compost tea spray on golf greens was the demonstration of potential drought tolerance. It would be worthwhile for staff to continue the use of compost tea spray for at least one calendar year. There is some possibility that compost tea spray could prove beneficial in the long run, and maybe even reduce the overall amount of fungicides required for maintaining high-quality, high-functioning golf greens.

Fraserview Golf Course, Green #1

SECTION 2: WHY TEST FERTILIZERS?

ENHANCING SUSTAINABILITY THROUGH PROCUREMENT

Each year the Park Board purchases a wide variety of goods and services for the maintenance of Park Board-operated sports fields. Besides grass seed, the list of products necessary for properly maintaining healthy fields of grass suitable for recreational and athletic activities includes fertilizers, and other soil amendments, such as lime. In terms of keeping within the interests of sustainable procurement, **a significant opportunity lies in selecting fertilizer products that are considered more sustainable than those currently in use; this includes products that could be used in lesser quantities to reduce the overall impacts of fertilizer application and use.**

In terms of overall sustainable practices, the Park Board is active in using Integrated Pest Management (IPM) practices to address insects, weeds, and disease pressure in park operations. In Vancouver, all neighbourhood parks, sports fields, and playgrounds are completely pesticide-free.[23] Vancouver Park Board does not use any neonicotinoid pesticides, nor do they purchase plant products treated with this class of pesticides.[24]

Since pesticides are not used in neighbourhood parks, or sports fields, the next opportunity for enhancing sustainable practices in the maintenance of sports fields lies in selecting fertilizer products that are considered more sustainable than those currently in use, including those that could be used in lesser quantities.

THE IMPORTANCE OF PARKS (AND PARK MAINTENANCE) IN URBAN LIFE

Human beings have a natural tendency to seek connections with other living things. Health studies increasingly demonstrate that contact with nature (plants, animals, pleasant landscapes, and wilderness) offers people a range of health benefits including improved physical health conditions, and reductions in stress. Research in "green exercise" emphasizes that exercise is more beneficial when activities occur in natural settings, like parks.[25]

Access to public green space in Vancouver supports Vancouver's Healthy City *Strategy*.[26] A target for improving access to public green space in Vancouver is mentioned in the *Greenest City Action Plan*:

[23] City of Vancouver, Integrated Pest Management policy, 2012.
[24] Shore, R., Vancouver park board institutes pesticide ban to help save honeybees, Vancouver Sun, 2014.
[25] American Planning Association – City Parks Forum Briefing Papers, How cities use parks to … Improve Public Health, 2003.
[26] City of Vancouver, A Healthy City for all, Vancouver's Healthy City Strategy, 2014.

"… that every person in Vancouver lives within a five-minute walk of a park, greenway or other public green space by 2020".[27]

Park spaces also play an important role in mitigating climate, air, and water pollution impacts on public, and environmental health. Trees in park spaces can help to reduce air temperature, and provide cool/shady rest areas in the heat of the summer. Alongside transportation routes, topsoil in park spaces can help absorb and filter polluted water run-off from impervious surfaces.[28] Natural areas can retain, and slowly release, significant volumes of rainwater, helping to recharge aquifers while enhancing water quality, reducing water pollution, and relieving stress on stormwater infrastructure systems.[29]

Park systems, including sports fields, play an important role in the urban environment, for all recreational and athletic users, and also in biological and hydrological cycles. As such, it is important to properly maintain parks. This means ensuring healthy soil, and healthy plants; healthy plants require adequate nutrient levels to support their growth. Without the addition of nutrients in some form, most park spaces will look like the pictures shown below by mid-summer. Dead grass will not help with the retention of water in the soil. Dry soils, especially in heavily used park spaces with a lot of foot traffic, are susceptible to compaction and poor soil structure, and subsequently, a severely reduced capacity to support healthy plant growth.[30]

Bobolink Park, next to Muirfield Dr. An example of a field that receives no fertilizer or irrigation. Note that the soil has become dry, compacted, and unsuitable for supporting healthy plant growth.

[27] City of Vancouver, Greenest City Action Plan, 2011.
[28] American Planning Association – City Parks Forum Briefing Papers, How cities use parks to … Improve Public Health, 2003.
[29] Okanagan Basin Water Board, Topsoil Bylaws Toolkit, 2012.
[30] DeJong-Hughes, J. et al. (DeJong-Hughes, Moncrief and Voorhees), Soil compaction: causes, effects and control, 2001.

THE USE OF FERTILIZERS

Fertilizers are products or materials that provide one or more of the chemical elements necessary for healthy plant growth and development. They can be classified as organic, and inorganic. Organic fertilizers will include manures, compost, or bone meal – materials derived directly from plant or animal sources. Inorganic, also referred to as commercial or synthetic fertilizers will include ammonium sulfate or ammonium phosphate – these are materials that have undergone manufacturing processes, although they are likely to have been mined from naturally occurring mineral deposits.[31]

There are advantages and disadvantages to using either one. Synthetic fertilizers usually contain only a few nutrients, typically Nitrogen, Phosphorus, Potassium, sometimes Sulfur or Iron. The nutrients are available in a concentrated form, but can be lost from the soil quickly unless using a formulated, slow-release type. Organic fertilizers usually contain much lower concentrations of plant nutrients, and are released much more slowly. The use of organic fertilizers provides additional benefits to soil, such as improving water movement in the soil, and the soil's overall structure. However, relying on organic fertilizers usually costs more because maintenance staff will have to apply materials more frequently, and in higher volumes to achieve the same nutrient benefits as synthetic, slow-release fertilizers.[32]

All fertilizers are regulated by the Canadian Food Inspection Agency under the authority of the federal *Fertilizers Act and Regulations*. Both provincial and municipal rules and regulations control the manufacture, proper use, and safe disposal of fertilizers (and supplement products) that are imported or sold in Canada. Even exempt products are still subject to regulation. All three regulatory bodies work together to ensure that all fertilizers and supplements meet the highest standards for safety.[33]

TESTING "GREEN" FERTILIZERS AT KENSINGTON SPORTS FIELD

INTRODUCTION

This study **compared different fertilizer products for use on a sports field**. Five products were included in the trial, three of which were "green" products recommended by the fertilizer vendor. The fourth product was the fertilizer regularly used by Park Board maintenance staff on sports fields, and the fifth product was a food scraps-based organic compost produced by a local food scraps-to-compost company.

[31] Savonen, C., Here's the scoop on chemical and organic fertilizers, 2008.
[32] Savonen, C. Here's the scoop on chemical and organic fertilizers, 2008.
[33] Government of Canada, CFIC Regulatory Oversight – Ensuring the safety of fertilizers and supplements in Canada, 2014.

The aim of the trial was to evaluate the effectiveness of the 5 products for use in regular maintenance of Park Board-operated sports fields.

Kensington (Lower) sports field was selected as the site for testing partly for its proximity to Fraserview Golf Course. Since Fraserview staff were asked to provide assistance with fertilizer application, and with maintenance of the painted lines delineating the test plots throughout the summer season, a site within a convenient traveling distance of Fraserview was necessary. Another reason for selecting Kensington was that the field is classified as a "Grass grade A" field, but does not display the same high-quality characteristics that other fields in the A class display. Amongst Park Board staff, Kensington (Lower) is known for being weedy, and prone to thin, patchy grass growth in many places. By testing on a lower-performing field, it was thought that it would be easier to visually spot any improvements made to the conditions of the field through the application of fertilizers. Also, if the field conditions were to worsen as a result of the testing, then damage would be significantly less than if the tests were to be conducted on a higher-performing field.

Kensington (Lower) is prone to heavy weed growth

Grass tends to grow in thin, and patchy

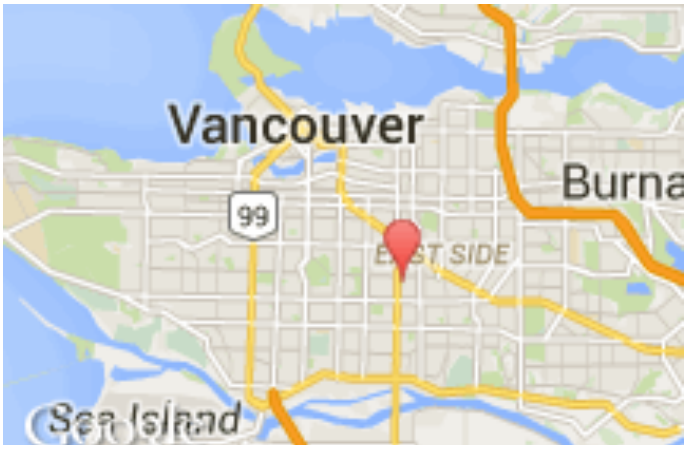
Grass plants are easily displaced by weeds; in this case, plantain. Note the difference in root massing and size. Once weeds move in, it is difficult for grass to compete with them.

White paint lines delineating the plots for the duration of the test

Kensington field is constructed in the same manner as other "Grass grade A" fields – with a sand base, sprinkler irrigation, and drainage tile. Kensington is a busy sports and recreation field. On any weekday evening in the summer, it is common to see simultaneous recreational sports teams (baseball, soccer), and dozens of other users across both the upper and lower field. In the words of the subforeman in charge of field maintenance for the Kensington area, *"Vancouver Parks are loved … to death"* – referring mainly to the difficulty that park operations crews face in keeping up with the maintenance required for keeping the fields in conditions suitable for all its many users and activities.

A reality for the state of parks in Vancouver – increasing density in neighbourhood areas, and increasing access to green space as per greenest city targets are leading to both an increase in overall park space, as well as usage and need for high-quality park spaces. Access to park space is undoubtedly a benefit to the neighbourhood community; however ensuring that adequate resources are made available for proper maintenance of park spaces is necessary for making sure public park spaces continue to be high-quality, and high-functioning areas that everyone can continue to enjoy for years to come.

Kensington (Lower) is the northernmost field
Image: City of Vancouver



Kensington (Lower) is near Knight Street and 33rd Avenue
Image: Google Maps

Kensington sports field is a heavily-used field for sports and recreational activities.

For the duration of the research test, lines were painted on Kensington (Lower), splitting the test area into 5 equally-sized, rectangular plots. Each of the 5 plots measured 50’ wide, and 150’ long for a total area of 7,500 square feet. Plots 1 - 3 received new “green” fertilizers. Plot 4 received the same fertilizer that is currently used on sports fields in the area. Plot 5 received mostly compost product; as much compost that could be transported in the back of a pick-up truck was applied. The southernmost 20-foot section of Plot 5 received no application of product, and was marked off as a control plot.

Fertilizer application

Compost application

Characteristics about the products applied to the different plots are described below:

Table 4: Kensington Test Plot Details

Product Characteristic	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Control
Product Name	Sustane Organic Fertilizer 5-2-4 + Fe medium granular	Evergro ProTurf Premium 34-0-9 with slow-release N	Evergro ProTurf Organic Plus 24-4-12 50% slow-release N	Evergro ProTurf Spring & Fall 23-3-23 50% slow-release N	OMRI Compost Topdressing 2-1-1 pathogen & weed free	Nothing
Additional Micros	Ca 3% Fe 2%	Fe 2%	Fe 0.05% Zn 0.02%	B 0.06% Cu 0.06% Fe 1.88% Mn 0.14% Mo 0.0016% Zn 0.13%	Ca 3.8% Mg 0.45% S 98 mg/kg B 17 mg/kg	
Application Rate	1.1 lbs of N/1000 sq ft	1.6 lbs of N/1000 sq ft	1.1 lbs of N/1000 sq ft	1.1 lbs of N/1000 sq ft	1 lbs of N/1000 sq ft	0
Total Applied	165 lbs	35 lbs	34 lbs	36 lbs	2 yards	0
Sustainability Factor	3.5% slowly available N Aerobically composted turkey litter Hydrolyzed feather meal	Slow-release N	Slow-release N Organic matter 15%	Slow-release N	Organic matter 58.6% Produced from food scraps Local company	

Weighing samples

Soaking samples

Using a vacuum chamber to penetrate roots with glomalin-dissolving solution

METHODOLOGY

(1) Determine products to be tested, and mark out plots
(2) Take soil samples and send for lab analysis
(3) Take soil core samples – the "before" samples. Wash roots and weigh.
(4) Apply "green fertilizer" products to test plots
(5) Do not fertilize fields through the test period, but otherwise provide regular maintenance (Cutting and irrigation). Be sure to treat control and test areas uniformly.
(6) Observe test plots throughout the season
(7) Take soil samples – the "after" samples. Wash roots and weigh.

Taking soil samples at the sports fields

A particularly long root being washed in the lab

RESULTS – VISUAL CHANGES IN COLOUR & ROOT MASS

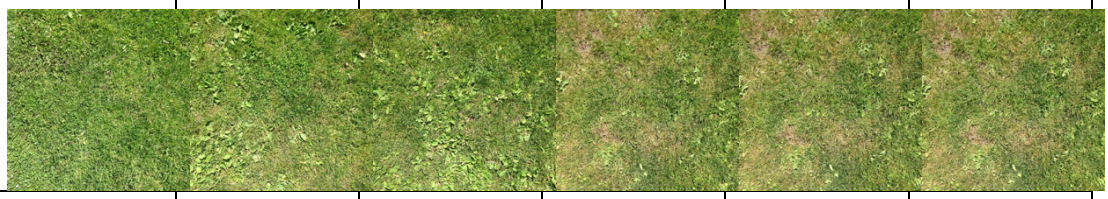
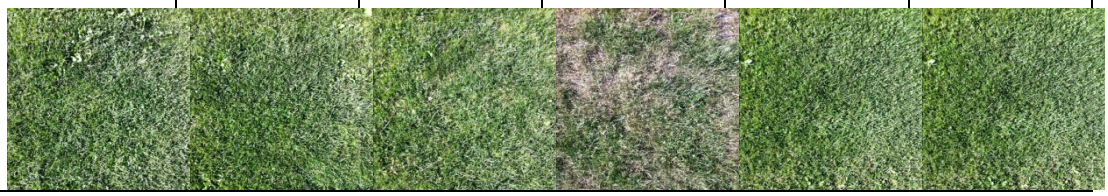
In terms of comparing different fertilizer products for use on a sports field, it was determined that the main indicators would be (1) Visual changes in colour, and (2) Root mass.

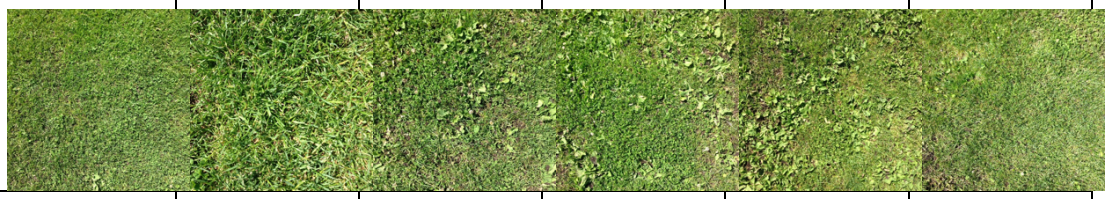
(1) Visual Changes in Colour

In evaluating the effectiveness of each fertilizer product, colour makes sense as an indicator because healthier grass plots should appear greener than unhealthy plots. It was expected that the plots would show a difference in colour throughout the test as the fertilizers were released at different rates into the soil.

The following table includes pictures associated with each test plot. It should be noted that mostly pictures from the very beginning and end of the test are shown. The summer of 2015 was unusually hot and dry. The summer drought, along with irrigation problems in the field, and water restrictions led to the fields mostly drying out for the middle portion of the test. A summer rain, and a bit of irrigation eventually revived the fields. Also, the quality of the grass within each plot varied – within each plot there were weedy patches, bare/thinning patches, and sometimes disease. An effort was made to capture pictures of "average" grass within the plot, but obviously this is a difficult thing to do when there is so much variation within a plot. In some cases, 2 pictures are included, showing both ends of the spectrum in terms of grass quality within a plot.

Table 5: Kensington Test Plots – Visual Changes in Colour

Date	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Control
May 30						
June 11						

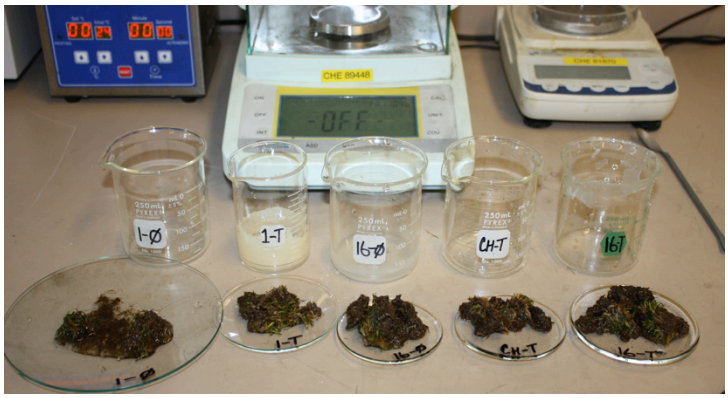
June 18	
June 23	 
July 3	 For the field to look this brown, it is likely that there were irrigation issues leading up to this date. On July 3, Stage 2 water restrictions were announced. Up until July 3, regular irrigation should have been taking place. Note: Plot 1 is distinctly green. Plot 2 is somewhat green, except for the dry areas. Plots 3-5 are clearly not exhibiting healthy plant growth.

July 6	 The irrigation was tested, but the issue of whether or not the sprinkling had been taking place prior to July 3 was never thoroughly investigated due to project time constraints.
July 9	 Despite irrigation issues and drought, Plot 1 continues to remain distinctly green.
July 16	 Plot 1 remains distinctly green. Plots 2 and 3 recover to a noticeable degree. Plot 4 only appears to be recovering, but only slightly. Plot 5 – no change.

July 31	 From a distance, the field looks like it has made a full recovery, but close-up photos show otherwise. See below.					
July 31						
	Distinctly green	Recovered	Recovered	No recovery	No recovery	No recovery

(2) <u>Root Mass</u>

Root mass was selected as an indicator in order to compare overall plant growth between plots. Soil core samples were taken from each plot at the start of the trial (May), and then again towards the end (early August). The following table shows the mass of the roots after core samples were collected, washed, and oven-dried (at 80°C). After thoroughly washing, sieving, and decanting the core samples, ideally only grass roots should remain. The root material was then oven-dried to remove any remaining water. Finally, the mass of the root material was measured with an analytical lab scale.



Oven-drying and weighing samples

Table 6: Root Mass – "Before" and "After" Fertilizer Applications

Sample	"Before" – June 2015		"After" – August 2015		Expected	Actual Results
	Mass (g)	% of sample	Mass (g)	% of sample		
Plot 1	6.4039	4.99	5.1017	3.36	Increase in root mass	Decrease in overall root mass
Plot 2	5.9782	5.13	4.4016	2.63	Increase	Significant decrease
Plot 3	3.657	3.33	4.0032	3.33	Increase	No change
Plot 4	3.1108	2.79	4.2027	2.71	Increase	Slight decrease
Plot 5	3.192	2.86	3.9908	2.79	Increase	Slight decrease
Control	4.3615	3.47	4.9724	3.77	Decrease	Slight increase

DISCUSSION

From Table 5, it can be seen that Plot 1 remained distinctly green through the entire duration of the test. It would seem that the Sustane Organic Fertilizer helped the grass to endure irrigation issues, a drought, and water restrictions.

Plot 2 and 3 recovered moderately after sufficient irrigation/rainfall helped the fertilizer to release into the soil. The July 31 photos show moderately healthy growth of the grass in those plots, but the grass is not nearly as healthy as shown in Plot 1.

Plot 4 appeared to recover somewhat, but the July 31 photo shows that recovery was actually quite poor; the grass growth turned out to be thin, patchy, and inconsistently green.

The control plot and Plot 5 actually looked similar throughout the duration of the test. This is likely due to the compost having such a low nutrient content – so low that it doesn't seem to contribute to growth of the grass at all. The use of the compost may have had other beneficial impacts on the soil; however, this study was very limited in terms of the selection of its indicators.

In terms of the root mass, none of the actual results matched what was expected. It is likely that the lack of irrigation, drought, and water restrictions disrupted plant growth enough to negatively impact the results of this study. Also, it should be noted that 2 months is an unusually short time frame for conducting any product trial. For fertilizer testing, a 4-6 month-long testing period would be more ideal. The results shown in Table 6 are to be considered inconclusive.

ADDITIONAL OBSERVATION – DENSITY OF GROWTH

On the last day of the testing period, one additional observation was made – that the density of growth in Plot 1 was greater than in any of the other test plots. No quantitative measurement was made. This observation was made qualitatively by walking barefoot across all of the plots. The grass in Plot 1 felt substantially thicker than in Plots 2 or 3, even though Plots 2 or 3 exhibited a similar colour to Plot 1.

CONCLUDING REMARKS

This study compared different fertilizer products for use on a sports field. Five products were tested, but only one was determined to be superior in terms of its effectiveness, and in its ability to withstand extreme conditions.

All products, including the Sustane Organic Fertilizer, were only applied once over the 2-month testing period in the summer. Under a normal sports field fertilization schedule, application of a fertilizer might take place twice over that same 2-month period. A compost, due to its low nutrient content, would require heavier, and more frequent application within that same time frame, which actually makes the use of compost impractical considering the resource and labour constraints that maintenance staff are under.

The most significant piece of evidence supporting the effectiveness of the Sustane 5-2-4 product was the distinctive green colour exhibited in Plot 1 during the duration of the test; also, higher density of grass growth was observed. Considering that just one application of the Sustane 5-2-4 ended up lasting the entire duration of the test period, resulting in a lush field of green grass even through a severe drought, it would be safe to conclude that Sustane 5-2-4 is a product far superior compared to all the other products tested. **It would be worthwhile to continue using the Sustane product, perhaps on a larger field area and over a longer period of time, in order to further assess its performance. For certainty, testing should be conducted for at least one calendar year.**

A future study should include a cost-benefit comparison, and sustainability/environmental impact review of the Sustane product as compared to the Evergro 23-3-23. Calculations should be included to determine whether switching products could result in (a) Lesser quantities of overall fertilizer being required, and (b) Fewer applications required by maintenance staff, potentially reducing their overall workload. This study should reveal whether an opportunity to reduce the overall impacts of fertilizer application and use, while continuing to produce high-quality, high-functioning sports fields, can be realized by switching products.

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