The Effects of Compost Tea on Golf Course Greens: Presidio Golf Course, San Francisco CA

Christa Conforti[1], Marney Blair[1], Kevin Hutchins[2], and Jean Koch[1]
CConforti@presidiotrust.gov
1. Presidio Trust, San Francisco, California, USA
2. Arnold Palmer Golf Management Company, San Francisco, California, USA

Abstract

In an attempt to reduce the need for pesticides and improve the overall health of turf and soil, the Presidio Golf Course conducted a field trial to evaluate the effects of compost tea applications on golf course greens under real-world conditions. Greens were sprayed at a rate of one gallon of compost tea per 1000 ft^2 for twelve months. Applications occurred weekly during times of high disease pressure, and bi-weekly during times of moderate or low disease pressure. Turf was evaluated for color, density, root depth, and disease and weed infestation. Soil was tested for carbon dioxide and oxygen level. Turf treated with compost tea had longer root length, and less microdochium patch than untreated turf. Treated turf did not differ from untreated turf in color, density, soil carbon dioxide, soil oxygen, or weed infestation. Compost tea has become an integral part of the Presidio Golf Course pest management and the overall turf maintenance program. Further trials are needed to evaluate various application rates and application methods to determine the full potential effects of compost tea on golf course turf and soils.

Introduction

Pest management on golf courses has traditionally included regular pesticide applications, particularly on greens. Many of these pesticides have the potential to harm wildlife, humans, or move into groundwater. Golf courses are under increasing scrutiny and pressure to minimize the use of synthetic turf care chemicals (Balogh and Anderson 1992; Walker and Branham 1992). This pressure comes both from within the golf course industry and from environmental and community groups (Dinelli 2000; USGA 1996). Because of this, many golf course managers are looking for effective alternatives to chemical pesticides and fertilizers. Compost tea, or aqueous extract of compost (Bess 2000), has been used in agriculture to suppress various fruit and vegetable diseases (Quarles 2001; Hoitink *et al.* 1997; Brinton 1995). Work with compost tea to suppress turf diseases and reduce fertilizer needs on golf courses is a relatively new endeavor (Ingham 2001).

The aim of this field trial was to evaluate the effects of a twelve-month compost tea regimen, under the conditions of a working San Francisco golf course. This trial was not intended to be narrowly focused, precisely controlled study. Rather, it was intended to determine if the regular use of compost tea was feasible within an environmentally conscious golf course superintendent's turf management program, and if this use would reduce the severity of the primary foliar turf diseases common to this course: microdochium patch (pathogen *Microdochium nivale)* and anthracnose (pathogen *Colletotrichum graminicola*). The trial also aimed to determine if the use of compost tea would increase soil microorganism and nutrient levels.

Materials and Methods

This trial was conducted from November 2000 through November 2001, at the Presidio Golf Course in San Francisco California, on two creeping bentgrass (*Agrostis* spp.*)* greens. Varieties of bentgrass on both greens were SR1119, SR1020, and SR1019. Both greens were sodded with this blend of bentgrass one year prior to the beginning of the trial, and they were maintained at a mowing height of between 0.125 and 0.18 inches. Both greens were subject to foot-traffic of approximately 70,000 rounds of golf during the duration of the trial. Each green was divided in half for the purpose of the trial; one side received compost tea applications while the remaining side received no compost tea. All other maintenance practices including mowing, fertilizer applications, dew-removal, and soil aerification, were uniform across each green. No pesticide applications occurred on these greens during this trial.

Compost and compost teas were made on-site. Compost was made from equal parts wood chips, grass clippings, and horse manure plus horse bedding. The recipe for this compost blend was produced with the help of Woods End Lab, ME. After compost was made, biodynamic preparations (Pfeiffer 1984) were added to the compost windrows. Mature compost was taken from compost piles no less than four months old that had previously been maintained at 135°F for three to five days. Compost tea was brewed in a fifty-gallon Growing Solutions Microbrewer® for the first six months of the trial, and in a one-hundred-gallon Growing Solutions System100® for the last six months. Before each brewing cycle, water was placed in the brewer and de-chlorinated by aerating the water for at least one hour. Additives, such as molasses and a compost tea catalyst by Growing Solutions (made of sea kelp, cane sugar, rock dust, and yeast) were added to the de-chlorinated water. Compost was then placed in the brewer baskets. One five-gallon bucket of compost was used in the Microbrewer®, and approximately two five-gallon buckets of compost were used in the System100®. Brewing occurred for eighteen to twenty-four hours, respectively. The resulting compost tea was transferred to a spray rig and applied to the turf within four hours of brewing time. Quality testing of the compost and compost tea was performed quarterly during the trial. Testing was performed by Soil Foodweb, Corvallis OR.

The compost tea was applied through a Smith Co. Spray Star 1600 boom sprayer with a fifteen-foot boom. Compost tea was mixed with de-chlorinated San Francisco municipal water, and sprayed at a rate of 1-gallon compost tea/1000 ft^2. Applications occurred weekly during periods of high disease pressure (November through March), and biweekly during moderate to low disease pressure (April through October). Applications generally occurred in the early morning before 7:30 am. Application methods alternated between (a) drench applications in which the spray was watered in with five to ten minutes of irrigation following the application, and (b) foliar applications, in which the spray was left on the surface of the green.

Analytical Methods

Each experimental green was divided into quadrants (two treated with compost tea, two untreated) for the following evaluations:

Percentage turf affected by weeds and disease symptoms were recorded weekly for one randomly selected square foot per quadrant.

A subjective rating of turf color and turf density on a scale of 1-10 was recorded weekly for one randomly selected square foot per quadrant.

Root depth was measured monthly by pulling a soil profile sample with a soil probe, to determine thatch and root depth (inches).

Soil CO_2 level, and soil O_2 level were measured monthly by placing a soil gas meter approximately two inches deep into the soil beneath the turf.

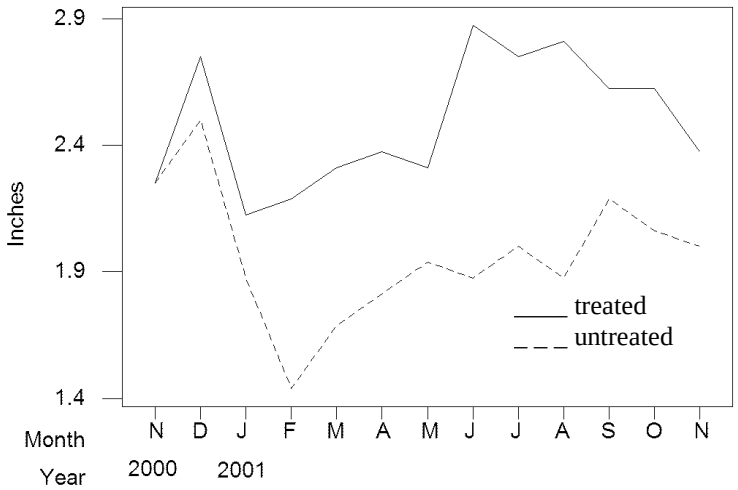
For all turf and soil characteristics except disease occurrence, data was graphed as time series plots of the mean value for each sample date, and an ANOVA for each characteristic versus treatment and date was performed on data from last ten months of the trial. For disease occurrence, data was graphed as time series plots of the mean disease occurrence for each sample date within the time span of high disease pressure, and an ANOVA for disease occurrence versus treatment and date was performed on data from time span of high disease pressure.

Results

Root Depth

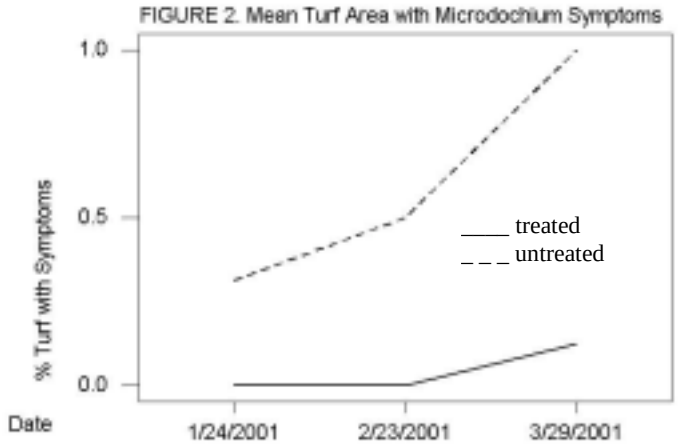
Figure 1 shows a time series plot of the root depth for treated and untreated turf. During the first two months of the trial, root depth of turf treated with compost tea did not significantly differ from untreated turf (P=0.120). During the last ten months of the trial, turf treated with compost tea did root significantly deeper than untreated turf (P=0.001). Mean root depths (n=4) during the last ten months of the trial for treated and untreated turf were 2.49, and 1.89 inches, respec
tively.

FIGURE 1. Mean Root Depth



Microdochium Patch

Figure 2 shows a time series plot of the microdochium patch symptoms during times of highest microdochium disease pressure, for treated and untreated turf. During this time, turf treated with compost tea showed less microdochium patch symptoms than untreated turf ($P<0.001$). Mean percent turf areas with microdochium symptoms (n=4) on treated and untreated turf were 0.042%, and 0.604%, respectively.



The Effects of Compost Tea on Golf Course Greens:
Presidio Golf Course, San Francisco CA

Anthracnose & Weeds

Figures 3 and 4 show time series plots of mean anthracnose damage (n=4) for times of high anthracnose disease pressure, and mean weed infestations (n=4) throughout the trial. Turf treated with compost tea did not significantly differ from untreated turf in terms of anthracnose symptoms (P=1.0) or weed infestation (P=0.519).

FIGURE 3. Mean Turf Area with Anthracnose Symptoms

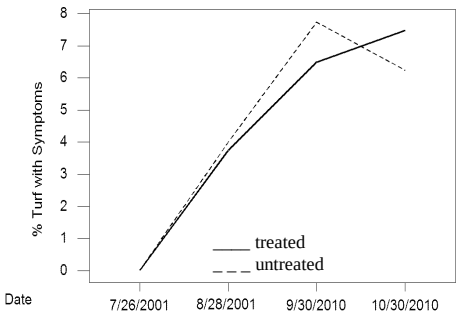
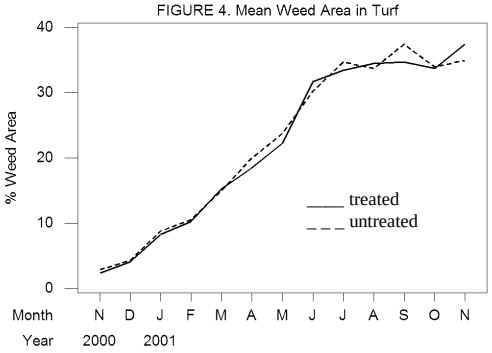
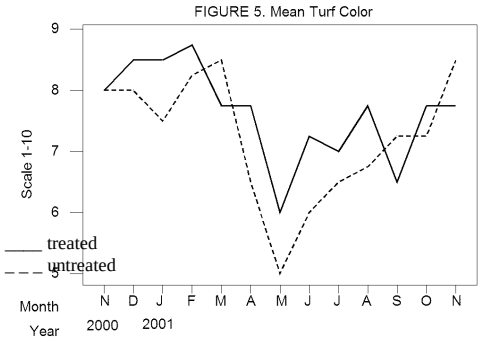


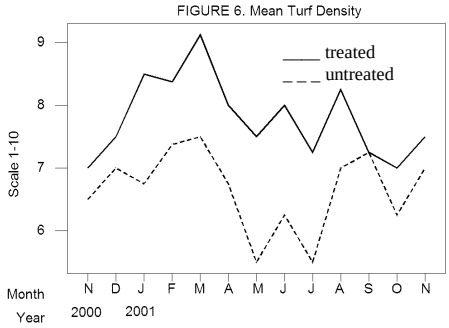
FIGURE 4. Mean Weed Area in Turf



Turf Color & Turf Density

Figures 5 and 6 show time series plots of mean turf color (n=4) and mean turf density (n=4) throughout the trial. Turf treated with compost tea did not significantly differ from untreated turf in color (P= 0.112) or density (P=0.110).





Soil CO_2 & Soil O_2

Figures 7 and 8 show time series plots of mean soil CO_2 levels (n=4) and mean soil O_2 levels (n=4) at a soil depth of two inches. Turf treated with compost tea did not significantly differ from untreated turf in soil CO_2 (P= 0.252) or soil O_2 levels (P= 0.584).

FIGURE 7. Mean Soil Carbon Dioxide Level

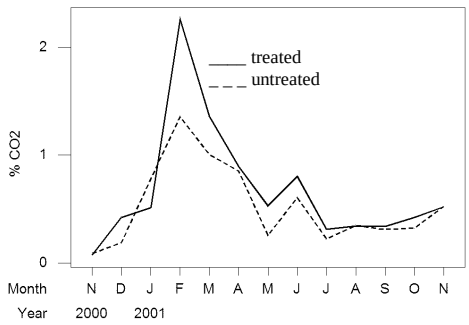
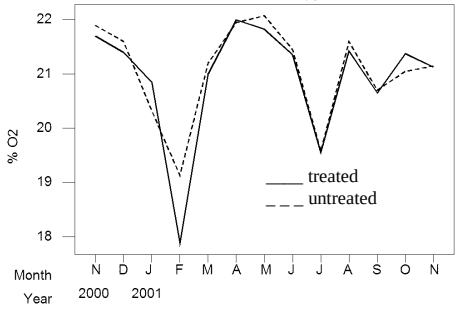


FIGURE 8. Mean Soil Oxygen Level



Conclusions

The use of compost tea on golf course greens suppressed the severity of microdochium patch although anthracnose was not affected. The difference in mean root depth during the last ten months of the trial was 0.60 inches, or a 31.7% increase. The difference in microdochium patch symptoms was 0.562%. While these differences were small, they were significant within the context of a golf course green. On turf that is under the stress of a 0.125-inch mowing height and the foot-traffic of 70,000 rounds of golf per year, and under the foggy conditions of San Francisco, both of these differences are substantial. Since a deeper root system allows turf to better withstand foot traffic and thresholds for turf diseases on golf greens are very low, these differences were significant to the golf course superintendent.

Areas that warrant further study include increasing the compost tea application rate or adjusting the application method to move the compost tea into the soil profile, and adjusting the recipe of the compost and compost tea to improve microbial aspects of the compost tea. Quality tests run during the trial showed high bacterial levels and moderate fungal levels in the compost tea (data not shown). Increasing the temperature during brewing, testing various catalysts, or allowing the microbe populations in the compost to further mature and stabilize might possibly improve the quality of the compost tea and influence the results.

More study is needed to fully understand how to use compost tea to its greatest benefit on golf course greens. However, due to the results of this trial, and additional work done to improve

the application protocol, compost tea has become an integral part of the pest management and general turf management program on all Presidio Golf Course greens.

References

Balogh, J.C., and J.L. Anderson. 1992. Environmental impacts of turfgrass pesticides. p. 221-353. *In* J.C. Balogh and W.J. Walker (ed.) Golf Course Management and Construction: Environmental Issues. Lewis Publishers, Chelsea, MI.

Bess, V.H. 2000. Understanding Compost Tea. *BioCycle*. 41(10):71-72.

Brinton, W., M. Droffner. 1995. The control of plant pathogenic fungi by use of compost teas. *Biodynamics*. 197:12-16.

Dinelli, Dan. 2000. IPM on Golf Courses. *The IPM Practitioner,* 22(8):1-8.

Hoitink, H. A. J., Stone, A. G., and Han, D. Y. 1997. Suppression of plant diseases by composts. *HortScience*. 32:184-187.

Ingham, E.R. 2001. *The Compost Tea Brewing Manual*, 2nd Ed. Soil Foodweb Inc., Corvallis, OR.

Pfeiffer, E. 1984. Using Biodynamic Compost Preperations and Sprays. Biodynamic Farming and Gardening Association. San Francisco, CA.

Quarles, W. 2001. Compost tea for organic farming and gardening. *The IPM Practitioner.* 23(9)1-8.

USGA. 1996. *USGA 1996 Turfgrass and Environmental Research Summary* The United States Golf Association, Golf House, Far Hills, NJ.

Walker, W.J., and B.Branham. 1992. Environmental impacts of turfgrass fertilization. P. 105-219. *In* J.C. Balogh and W.J. Walker (ed.) Golf Course Management and Construction: Environmental Issues. Lewis Publishers, Chelsea, MI.