CUTT

Oxygen Injection and Bentgrass Rooting

Program Spotlight

The observation that monthly oxygen injection increased root growth at the injector indicates that the concept of oxygen injection to enhance root growth appears to be sound. The lack of improved root growth away from the injector indicates that a better system of injection is needed.

This project set out to determine if periodic oxygen injections of root zones could enhance root growth by delaying summer decline or stimulating spring and fall growth, and improve the visual quality of creeping bentgrass greens.

Materials and Methods

The site for the study was the soil amendment putting greens area of the Cornell University Turfgrass Field Research Center. The study consisted of using mini-greens 7.5' in diameter, 18" deep to simulate a typical tri-layer modern putting green profile of 4" of gravel, covered with 2" of coarse sand that is capped with 12" of a sand-organic amendment. In this study, there were 4 plots of 3 organic amendments: reed sedge peat, composted brewery waste and composted sewage sludge. Each amendment was used to modify sand at an amount equal to 1.5% organic matter, by weight, or approximately 20% by volume. Four additional plots had a native soil (Arkport fine sandy loam) as the entire 18" profile, typifying the old "pushup" style green. The site was established in the mid-1990s.

The site was mowed generally 3 times per week, clippings removed, and irrigated to prevent wilt. Disease activity was allowed to occur before a fungicide was applied. Dollar spot disease did occur on this site in July-August, however, there were not noticeable differences between treatments and the area was sprayed with a fungicide.

Treatments consisted of oxygen injection at different monthly frequencies of 1, 2 and 4 times per month. A non-injection treatment was included (just had oxygen injector installed). Each of the 4 injection treatments were applied to one of the 4 plots of each soil. The results from the sand amended plots were averaged. The oxygen injection treatment applied 5 pore volumes of oxygen of 150 cubic feet for the sandy loam soil greens and 100 cubic feet for the sand-organic amended greens. The oxygen generator produced 12 cubic feet per hour and injection times were 8 hours for the sand greens and 12.5 hours for the sandy loam greens. Injectors were constructed of 1/2" diameter schedule 40 PVC, with the first 8" being solid and the bottom 2" having slits. Four injectors were installed

Figure 1. Root growth in the sandy loam soil immediately adjacent to the oxygen injector.

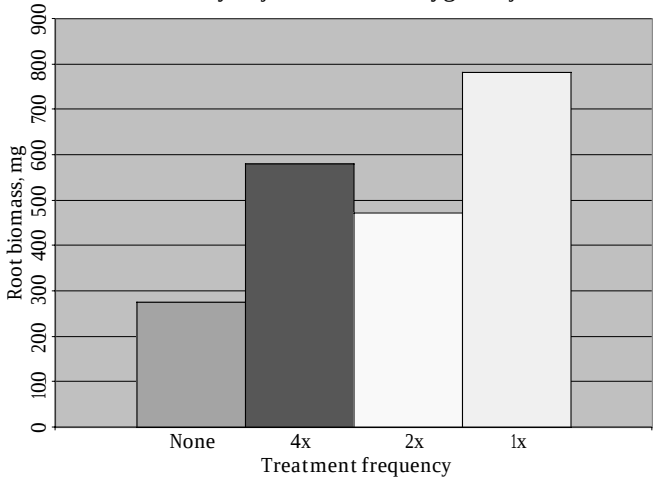
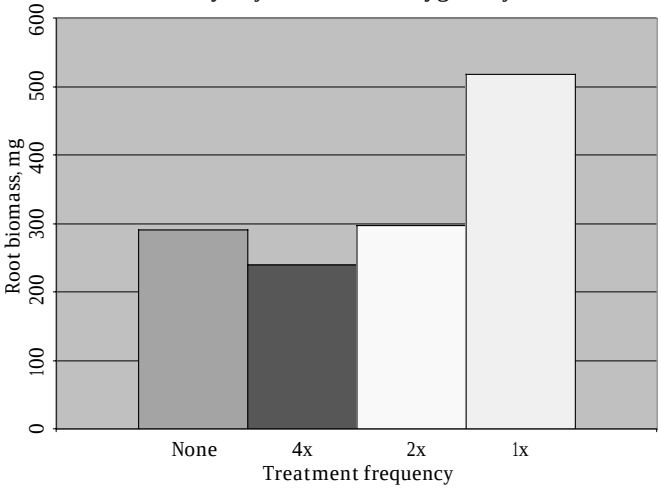


Figure 2. Root growth in straight sand immediately adjacent to the oxygen injector.



in each plot. Injection began in the first week of May 1999 and continued until the last week of October 1999.

Data collected included root biomass and length. There were not noticeable visual quality or disease occurrences between plots so data on individual plots were not recorded. Root biomass samples were collected monthly. Sampling consisted of 4 root samples per plot of 2 cm diameter, 12" deep sample taken 9" and 18" from each injector. Samples were frozen, washed to remove soil, oven dried at 55°C for at least 24 hrs., and weighed. On the last sampling date (10/25/99) a sample was taken directly next to the injector for biomass and depth of rooting.

Results

For each major soil type (sand and sandy loam) Figures 1 and 2 show root biomass at the injector (emitter) for each of the treatments at the end of the study.

The following are general comments on seasonal rooting behavior and soil differences:

- There is the typical summer seasonal decline in the root system with an increase in growth in late summer.
- There are slightly more roots in the sandy loam greens than in sand greens.

The following are results relating to oxygen injection:

Sandy loam greens: there was a substantial increase (2 to 3 fold) in root biomass directly adjacent to the injector during the late fall sampling period, most notably with one injection per month (3 times increase in biomass). Root length at the injector was greater primarily with the once per month oxygen injection. At either 9" or 18" away from the injector, the impact of oxygen injection on root growth is less evident or consistent. Oxygen injection did not stop the summer seasonal decline in root biomass. In the late fall, there was a slight increase in root biomass with the 4 times/month oxygen treatment. It must be pointed out that there were not replicate plots and therefore the data is subject to possible over interpretation.

Sand greens: there was a substantial increase in root biomass and length with one monthly oxygen injection at the injector in the late fall. Two injections per month also increase the length of roots at the injector. At 9" and 18" from the injector there was little if any impact of oxygen injection on root growth.

Summary and Recommendation for Future Research

The observation that monthly oxygen injection increased root growth at the injector indicates that the concept of oxygen injection to enhance root growth appears to be sound. The lack of improved root growth away from the injector indicates that a better system of injection is needed. The 1/2" injector inserted 10" deep with the bottom 2" perforated appears not to be adequate to distribute oxygen very far from the injector. Therefore, any future research may need to be directed at improving oxygen injection to a much greater distance from the injector to be beneficial in golf course management.

A. Martin Petrovic

Enhanced root growth was observed at the site of oxygen injection.

The oxygen injection treatment applied 5 pore volumes of oxygen of 150 cubic feet for the sandy loam soil greens and 100 cubic feet for the sand-organic amended greens.

In sandy loam greens there was a 2 to 3 fold increase in root biomass directly adjacent to the injector during the late fall sampling period, most notably with one injection per month.

Two injections per month also increase the length of roots at the injector. At 9" and 18" from the injector there was little if any impact of oxygen injection on root growth.