Zeolite Use in Sand-Based Systems

An experiment was conducted to evaluate the usefulness of two ZeoponiX zeolite treatments as amendments of sand-based golf greens. The site for the study was the Cornell University Turfgrass Field Research Facility in Ithaca, NY.

Three replicate plots of each of the two ZeoponiX treatments were arranged in a completely random design. Plots consisted of 2 m dia. by 45 cm deep plastic containers (swimming pools) fitted with a drain to collect leachate.

The soil profile consisted of 15 cm of gravel at the base and 30 cm of Zeopro-sand root zone material. The mixing was done in a cement mixer on June 2, 1998 and stockpiled under cover until the pools were filled on June 4, 1998. The plots were covered with tarps until seeding. The site was seeded with creeping bentgrass (at a rate of 1 lb. seed/1,000 sq.ft. with Penncross and L-93) on June 18, 1998.

Fertilizers were applied starting on July 20, 1998 with ammonium sulfate as the N source and potassium sulfate for K applied at a rate of 1 lb. N/1,000 sq. ft of N and K_2O. Fertilizer was applied in a hand held shaker on August 3,17, 31 and September 14 and 28. To facilitate rapid establishment, the plots were irrigated for 5 minutes each hour from 6 am to 6 pm until plot cover reached 100% (July 31, 1998) at which time a more moderate irrigation schedule was followed (about 50% of the above amount).

Clippings were harvested for yield and nutrient recovery (N, K, P, etc.) Clippings were sampled by taking one pass of a Toro walking greens mower set at 0.25 inch height. Mowing was done on an as needed basis and clippings were dried at 60° C for at least 24 hours prior to weighing and combined for the periods listed above. The clippings were analyzed for nutrient content at the Cornell Nutrient Analysis Laboratory for total N , K and P.

Leachate was collected daily or as needed. The volume was recorded and a subsample was saved and refrigerated. A weekly combined sample was made taking a proportional amount of the daily subsamples. All weekly samples were analyzed by the Cornell Nutrient Analysis Laboratory for NO_3-N, NH_4-N and K.

Visual quality was recorded using a scale of 1 to 9, where 1 is bare soil, 6 acceptable turf and 9 ideal turf. The establishment rate was visually estimated on the same dates as the visual quality determination. Soil samples were collected for soil moisture release characteristics and CEC.

Nutrient Leaching

In general, there were no differences in the volume of leachate between treatments except for week 1 where the half-fertilizer rate Zeopro plots had higher leachate volume than the other treatments. Except for the first two weeks, there were no treatment differences in K or NH_4 leaching. During the first two weeks both Zeopro treatments had slightly higher amounts of K and NH_4 leaching which is not surprising since K and NH_4 were not applied to the control (sand/peat) plots until week 4.

Nitrate leaching was influenced by the addition of Zeopro to the sand. Especially early in the study, the amount of NO_3 leached was significantly higher than from the sand/peat control plots. From week 9 forward there were no differences in NO_3 leaching. Averaged over the entire study, the amount of NO_3 leached was significantly higher than the sand/peat control plots. The higher leaching may be due to two reasons. First, N was not applied to the control plots until week 4, where the Zeopro plots had N preloaded. Second, it appears that the amount of N preloaded on the zeolite may be more than the turfgrass plants could use and therefore, the excess N was likely to be leached (see Table 1).

Visual Quality and Turf Density

Zeopro dramatically improved quality (density, color and uniformity) as compared to the standard root zone material of sand/peat. From 29 to 43 days after seeding (DAS), the Zeopro plots had an average of 3 quality units higher than the sand/peat plots.

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Program Spotlight

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Zeolite Influences

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From 29 to 43 DAS, the turf density of the Zeopro plots were 2 to 4 times higher than the sand/peat plots. This rapid rate of establishment has not been observed in other experiments we have conducted.

The turf density on Zeopro amended sand plots doubled from 18 to 29 DAS, whereas, the turf density of sand/peat control plots only increased slightly during that time frame. From 29 to 43 DAS, the turf density of the Zeopro plots were 2 to 4 times higher than the sand/peat plots. This rapid rate of establishment has not been observed in other experiments we have conducted. The overall average visual quality and turf density was enhanced with the addition of Zeopro fertilized at either rate (see Table 2).

Root Length

Roots can be measured by mass or length. Root length often is a better indicator of turfgrass health and growth recovery than biomass. The addition of Zeopro to sand fertilized at either rate had twice the depth of roots at the end of the study in November 1998. This indicated that the Zeopro provided a better environment for root development, which may be related to the phosphorus effect on rooting (see Table 3).

Summary

The addition of Zeopro to sand improved the establishment rate of creeping bentgrass, visual quality, CEC, moisture holding capacity, and rooting depth compared to the standard root zone amendment peat. There was little difference in response between full and half rate fertilization programs with Zeopro. However, there was more nitrate leaching from Zeopro-amended plots than from the sand/peat plots. This indicates that there was more N in the system than the turfgrass plants could use or that could be stored on the Zeopro exchange sites. Therefore, it may be necessary to use less Zeopro in the mix or only modify a smaller portion of the root zone (less than 12 inches) or pre-load less N on the CEC sites to reduce the potential for nitrate leaching.

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Table 1. Average leachate volume and nutrient mass leached for each treatment over all 10 collection periods.

Treatment	Leachate volume	Nutrient mass leached		
		K	NO_3-N	NH_4-N
	---------- l ----------	---------- g ----------		
Sand/peat	355 a	0.897 a	2.05 a	0.00 a
Zeopro (full rate)	316 a	1.56 a	14.1 b	0.096 a
Zeopro (half rate)	219 a	2.04 a	11.4 b	0.00 a

**Note: Values followed by the same letter are not significantly different; values followed by a different letter are significantly different.*

Table 2. Turf density and visual quality mean comparisons over time intervals.

Treatment	Visual quality	Turf density
	Scale of 1-9	%
Sand/peat	2 a	31 a
Zeopro/full rate	5 b	81 b
Zeopro/half rate	5 b	75 b

**Note: Values followed by the same letter are not significantly different; values followed by a different letter are significantly different.*