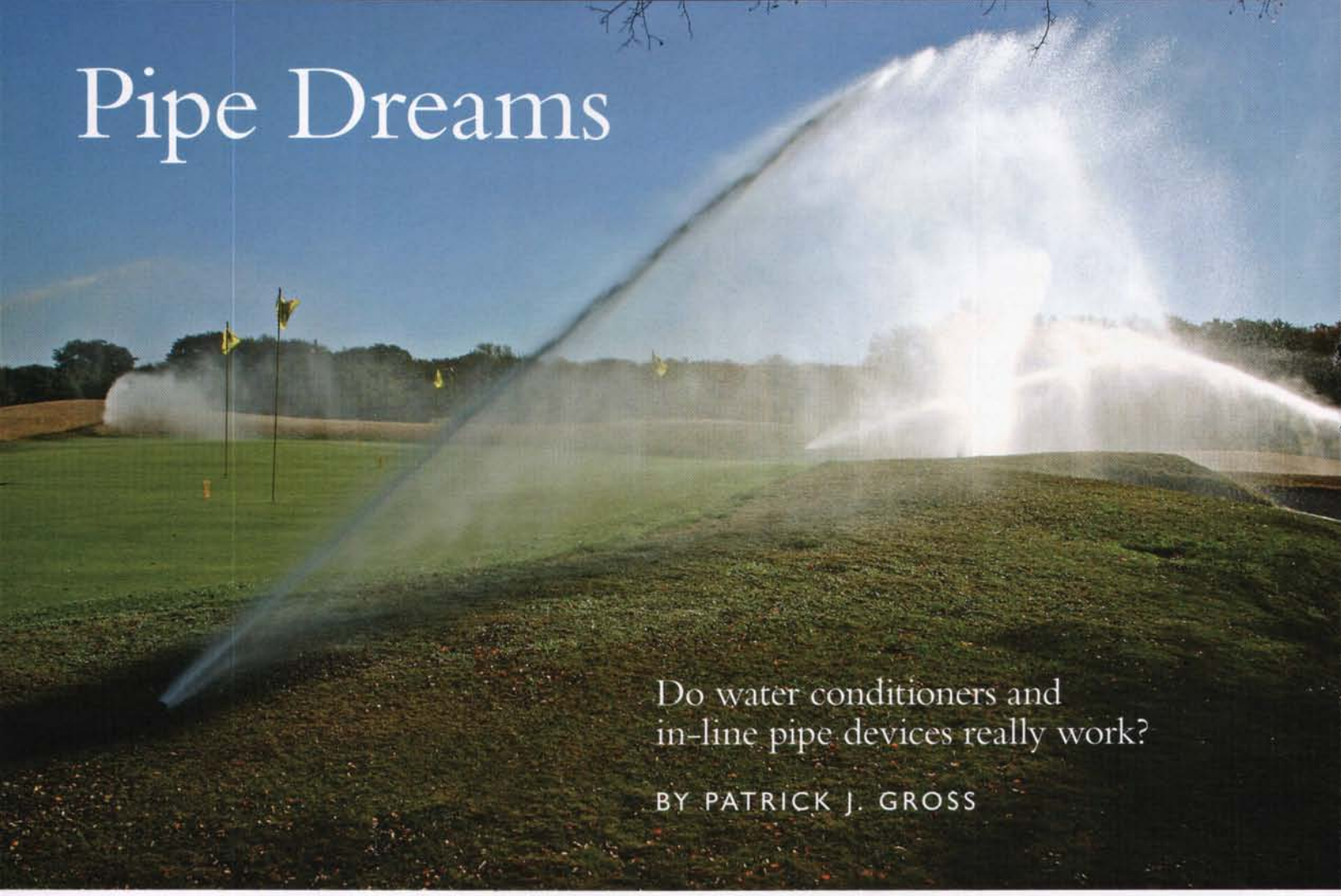
Pipe Dreams



Do water conditioners and in-line pipe devices really work?

BY PATRICK J. GROSS

Considering that water is applied to turfgrass far in excess of any other material, it is not surprising that there is considerable motivation to improve water quality and its corresponding benefit to turf. Such is the premise behind many of the water conditioners and in-line pipe technologies that are on the market today. Non-chemical water conditioners and in-line pipe devices are marketed as methods to easily and effectively treat irrigation water. Manufacturers claim that the treatment process will provide many benefits, such as improved water penetration, reduction of soluble salts, healthier turf growth, reduced labor, and lower overall water use. The question is, do these devices really work?

TYPES OF CONDITIONERS AND DEVICES

Water conditioning devices work on different principles and can be classified into four broad categories: magnetic/electromagnetic devices, electrostatic precipitators, catalytic devices, and ozone/oxygen treatment devices (Duncan, 2009). Following is a brief summary of the various claims made by the manufacturers of these devices:

- **Magnetic/Electromagnetic Devices:** Magnets placed on the outside of the pipe or within the pipe are reported to break the bond between minerals and water molecules to increase the solubility of water. This is claimed to reduce surface tension for better water penetration and more uniform spray coverage. (Hahn Application Products, LLC)
- **Electrostatic Precipitators:** These pipe devices are connected to an electrical source and induce a significant electrical charge into the water. This is reported to add electrons to the water, thereby improving water infiltration and producing a positive impact on turf health. (Brochure: *The Science of E.S.P.*)
- **Catalytic Devices:** A turbulent flow of water is created over dissimilar precious and semi-precious metal to cause a change in the calcium carbonate mineral that is reported to reduce scale deposits. In turf applications, this is claimed to allow soil pores to open, reduce soil

compaction, and leach excessive salts from the soil. (Fre-Flo Water Systems, Inc.; Zeta-Core USA, LLC)

- **Ozone and Oxygen Treatment:** These are generally electronic devices that inject ozone into water, creating hydrogen peroxide and nitric acid. This is reported to increase the solubility and dispersion of solids and mineral salts. Manufacturers report significantly higher dissolved oxygen levels in treated water, which is thought to improve plant growth. (Brochure: *Nitrox GTS*, 1999)

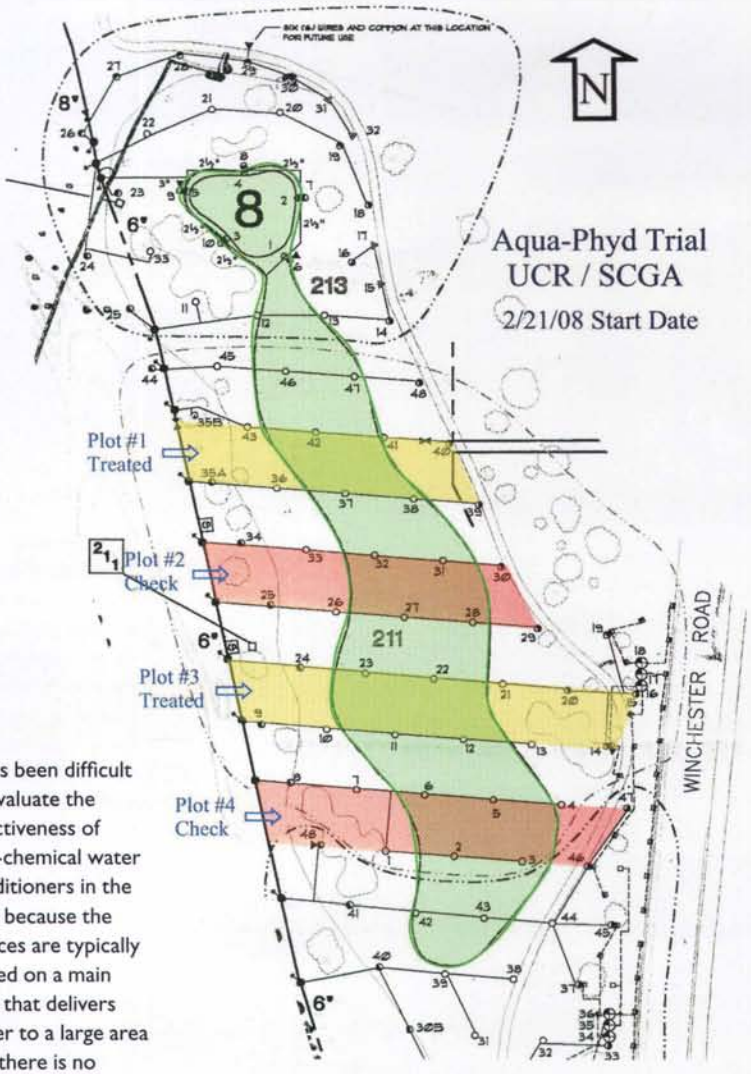
WHAT DOES THE RESEARCH SAY?

There are very few peer-reviewed scientific studies performed on non-chemical water conditioner devices. Following is a brief summary of the limited tests conducted in a turfgrass environment:

- A 1994 study by Shepard, Edling, Reimers, and Meckling investigated the ability of magnetically treated water to affect surface tension, capillary rise in four soil types, and percent oxygen saturation. No differences were observed. (Shepard, Edling, and Reimers, 1995)
- A 2003 study by Martin and Gazaway evaluated the short-term effects of using a non-chemical catalytic device (Carefree Water Conditioner) for treating poor-quality irrigation water in combination with deficit irrigation treatments on Tifway bermudagrass. They evaluated turf visual quality, growth, and water use efficiency. The results of the study indicated:
  - Regardless of the amount of water applied, there was no effect on Tifway quality by using water treated with the catalytic device.
  - The treated water had no impact on soil salinity (TDS), sodium adsorption ratio (SAR), sodium content, exchangeable sodium percentage (ESP), or electrical conductivity (EC_w).
  - In this study, Tifway quality, clipping yield, and water use efficiency were not affected by the salt or sodium content of the water. (Martin and Gazaway, 2003)
- A 2005 study by Leinauer, Barrick, and Robertson investigated the effect of four different non-chemical water conditioners on perennial

Non-chemical water conditioning devices are marketed as a method to easily treat irrigation water, improve soil properties, enhance turf growth, and save water. The question is, do these devices really work?

Basic agronomic programs, such as gypsum applications, have proven to be effective for reducing harmful levels of sodium and improving soil properties. Recent scientific studies have not proven a positive effect on soil properties with the use of non-chemical water conditioning devices.



It has been difficult to evaluate the effectiveness of non-chemical water conditioners in the field because the devices are typically placed on a main pipe that delivers water to a large area and there is no option of including a non-treated check area for comparison. A better test would be to include both treated and non-treated areas on a single fairway as noted with this experimental design by Drs. Green and Wu at the SCGA Golf Course.

ryegrass establishment, turf quality, and stress tolerance. The test included the use of both saline and potable water. Devices tested included a magnetic conditioner (MagnaWet), non-grounded catalytic conditioner (FreFlo), and a grounded catalytic conditioner (Zeta-Core). An additional treatment using the Aqua-Phyd conditioner was included in 2007. The results of this study showed:

- There was no statistically significant impact on perennial ryegrass establishment with the use of any of the non-chemical water treatments.
- After three years of turf performance data, the non-chemical water conditioning devices had no consistent effect on turf quality or stress tolerance.
- Treated water had no impact on soil chemical properties in either the saline or potable irrigated rootzones. (Barrick, Leinauer, and Petermeier, 2005; Leinauer, Barrick, and Robertson, 2006)
- Green and Wu initiated a study in February 2008 at the SCGA Golf Course in Murrieta, California. They evaluated the impact of resonant frequency energy waves generated by the Aqua-Phyd treatment device on a highly compacted saline soil. Measurements included water chemical factors (EC, pH, SAR adj, sodium, chloride, boron, bicarbonate, carbonate), soil chemical factors (EC_E, SAR, sodium, calcium, magnesium, potassium, carbonate, sulfate, chloride), soil fertility factors (potassium, magnesium, calcium, sulfur, iron, boron, sodium, pH, CEC), and soil physical factors (organic matter, soil particle size, bulk density, gravimetric soil water content, water infiltration rate, micropenetrometer readings, and compaction readings using the Field Scout Compaction Meter). Final data were collected in January 2009. Although the results still are being analyzed, researchers have not seen a significant difference in the data between the treated plots and the control plots. (R. L. Green personal communication, January 2009)

WILL IT WORK ON THE GOLF COURSE?

It has been difficult to evaluate the effectiveness of non-chemical water conditioners in the field, mainly because the devices are typically placed on a main pipe that delivers water to a large area. This technique will rarely provide an indication of whether the product works because it lacks an untreated check area for comparison. A better test would be to either treat half of a fairway and leave the remaining half untreated, or test adjoining fairways.

Furthermore, it is difficult to separate the many variables involved in such field evaluations. Have maintenance practices changed since the new water treatment device was installed? Has the course purchased a new aerator or other cultivation equipment? Have there been changes to the fertility or soil amendment program? Have there been changes to the irrigation system or scheduling of water applications? All of these variables need to be noted and honestly evaluated regarding their impact on field trials.

If consideration is being given to purchasing a non-chemical conditioner, take the following steps:

As the water crunch becomes more severe, there is considerable motivation to improve water properties and make every drop count. The manufacturers of non-chemical water conditioners claim to "make water wetter" and improve penetration into the soil. Such claims have yet to be proven by peer-reviewed scientific research.

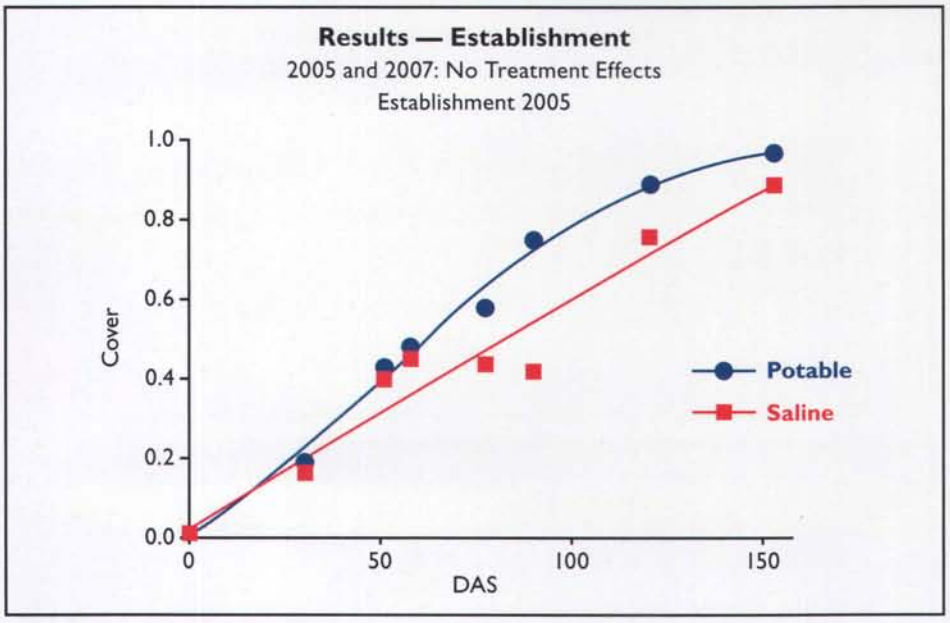
- Do your homework. Look for replicated scientific studies that provide data to support the claims made by the manufacturers. A good reference on water chemistry and a scientific perspective on treatment devices is the Web site by Lower: www.chem1.com/CQ. Many times, manufacturers' literature includes numerous testimonials. Although it is nice to know that some courses have observed a positive effect, such personal observations do not hold up to scientific scrutiny.
- Perform a test on a limited area, preferably one half of a fairway treated and the other half non-treated.
- Compare the cost of the unit with the cost of standard agronomic practices. Will the use of the device eliminate the need for aeration, soil amendments, or wetting agents, or will these products and practices continue to be employed?
- Collect data by testing the soil and water before treatment begins and every three months during the evaluation period.

CONCLUSION

The peer-reviewed scientific studies done on non-chemical water conditioners show that there is no effect on water or soil quality, yet some golf courses using these devices claim to see a benefit. Is this true, or is it just "faith-based agronomy"? Current methods of analysis have been unable to track any significant statistical changes in soil

chemical or physical properties, improvement in water quality, or enhancement of turf growth. Will they work in certain situations? It has yet to be proven. Companies that are willing to submit their products for unbiased scientific testing are to be commended, and future studies may show a statistically positive result.

Is it a pipe dream, or does the technology hold promise? With budgets being slashed and a challenging economy, any course considering such a purchase should be confident that money spent on such devices will produce a positive result. Current scientific studies have not proven that the technology works, making it difficult to justify such an investment.



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Soil Test Results (2007)

	pH	EC	Soluble Salts (dS/cm)	SAR	HCO_3 (ppm)	Na (ppm)	Mg (ppm)	Ca (ppm)	Cl (ppm)
Block	n.s.	*	n.s.	n.s.	n.s.	*	n.s.	**	*
Conditioning	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water	***	***	***	***	***	***	***	*	***
Conditioning × Water	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Depth	**	***	***	***	n.s.	***	**	n.s.	*
Conditioning × Depth	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water × Depth	*	*	**	***	n.s.	*	*	*	*
Conditioning × Water × Depth	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.