

USGA and Wayne R. Kussow Wisconsin Distinguished Graduate Fellowship endowed by the Wisconsin Turfgrass Association.

At first, we figured this iron cementation was a rare problem that was specific to the tropics because the only other case that we knew of was from a club in Vietnam. However, after randomly sampling greens from all over the US, Glen estimates that 25% of all USGA greens will show



Figure 1. Red iron and black manganese accumulating at the pea gravel/sand interface of a USGA putting green. (photo; Obear)

some evidence of iron cementation at the pea gravel/sand interface. Glen selected five of the most developed iron layers for further study and found that the layers are indeed composed of iron and manganese oxides (Figure 1). The iron and manganese move down from the top layers of soil and horizontally from upslope areas. As a consequence, the iron layers are usually most severe at the lowest laying areas in putting greens.

Figure 2. An iron layer is beginning to form at about four inches down because of textural discontinuity where fine topdressing sand sits on top of the original root zone mix. (image Obear)



Glen also identified a handful of cases where the iron layer developed in the root zone around a depth of three or four inches (Figure 2). In these cases there always was a textural discontinuity where the layer formed. A textural discontinuity is just a fancy way of describing the place where finer particles sit on top of coarse particles, or vice versa. For example, we normally find the layer right where the sand sits on the pea gravel, but have also seen it where fine topdressing sand sits on top of the original, coarser root zone mix. This finding highlights the importance of matching your topdressing with your root zone mix.

There is still a lot of work that needs to be done to figure out why these layers form in some cases and not others. We don't know how much iron fertilizers contribute, but if it were me I'd be very conservative with iron applications on my USGA greens. Also, we do not know if anything can be done to reverse the layer formation that won't also kill the turf. I expect Glen will continue to investigate this throughout his career.

While studying the iron layer, Glen was also investigating the influence of high bicarbonate water on sand root zone quality. It is thought by some that bicarbonate is a problem because after entering the soil, it will react with calcium to form calcium carbonate. If this occurs, some fear that the calcium carbonate will clog soil pores. A few prominent turf scientists have written about high bicarbonate water having the potential to cause "surface sealing of pores" which will reduce air and water infiltration. The solution to the supposed problem is to treat the water to remove the bicarbonate, or treat the soil to dissolve the calcium carbonate. However, I am quite skeptical of this being a serious issue because irrigation water in southern and eastern WI has some of the highest bicarbonate levels in the country. If bicarbonate was such a problem, you'd think we'd all be in agreement about it and solutions would be in place. This doesn't seem

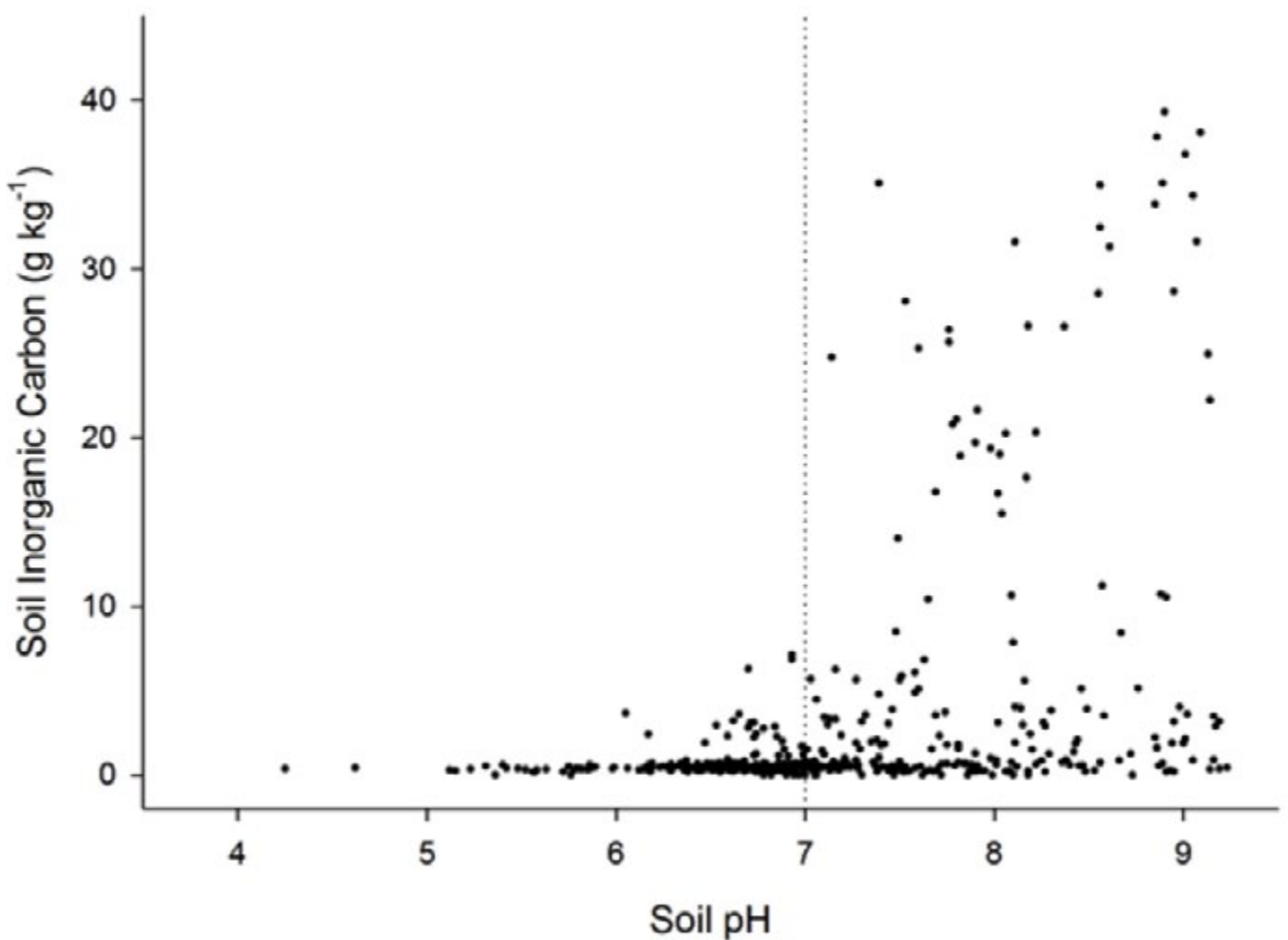


Figure 3. Soil inorganic carbon (AKA calcium carbonate) is really only found in soils where the pH is above 7. If your pH is below 7, you'll never have to worry about bicarbonate from the irrigation water precipitating.

to be the case. Some folks treat for high bicarbonate and swear by the results, others don't and are perfectly happy with conditions.

So Glen attacked the issue from two fronts. He sampled USGA greens and irrigation water from all over the US and analyzed and compared the results. The hypothesis was that areas water high in bicarbonate will have soils rich in calcium carbonate. But this turned out to be false. Instead Glen found that if soil pH was less than 7, there was little chance

of finding calcium carbonate in the soil. If soil pH was >7 , you may or may not find calcium carbonate in the soil. The implication here is that if you maintain soil pH below 7, there is no need to worry about bicarbonate in the water or the potential for pore clogging.

However, we really don't know if the high pH soils with calcium carbonate build up had a problem with reduced pore space. So Glen designed a greenhouse study where he irrigated bentgrass with pure water (no bicarbonate) and water nearly saturated with bicarbonate. After about three years' worth of evapotranspiration and no drainage, he found a small amount of calcium carbonate build up, but no evidence for clogging of pores. In fact, the pure water was found to have a higher degree of clogged pores. The exact reason for this is unknown, but we think it may have something to do with the pure water causing the peat moss in the soil to expand to a greater extent than happens with the bicarbonate water.



Figure 4. A white crust of calcium carbonate is starting to form on top of the algal mat. (Image: Obear)

Many of us have seen the white crust that develops on thin or dead spots on putting greens. Glen tested it at the O.J. Noer Research Facility and found that the white crust was indeed calcium carbonate. However, the calcium carbonate crusts we found were always associated with an algal crust. When the turf thins, the algae quickly fills in and forms a crust, and the high bicarbonate irrigation water reacts with the algae to form a white crust on top of the algal mat. So our hypothesis is that the white crust is often mistaken as the cause of the problem when it is simply an artifact of the algae and the water. The real problem is whatever caused the turf to thin so the algae could proliferate and form a mat (shade, compaction, scalping, heat stress, etc.). Like the iron issue, there is much more to learn about bicarbonate, but right now, we think you're much better off spending money to correct drainage and shade problems to prevent turf thinning rather than an acid injector to treat your irrigation water.

Last May, Glen packed up and moved to Lincoln, Nebraska with his wife, Lisa, their son Eli. There, Glen is pursuing his Ph.D. at the University of Nebraska with former Badger Dr. Bill Kreuser. I know Glen and Bill are doing some really great work together and making us proud.

The editorial staff of the MGCSA publication Hole Notes gratefully appreciates the help we receive through articles contributed from the Wisconsin Grassroots Magazine, Editor David Brandonberg and the Agronomic Scientists, such as Dr. Doug Soldat, at UW, Madison.

Want more information on mineral deposits in putting greens? Attend the Advanced Agronomic Forum to be held December 3rd at Medina Golf and Country Club. Hear the latest information from Dr. Bill Krueser, University of Nebraska.



Pre-registration closes on November 27, 2013

Advanced Turf Agronomy Forum

December 4, 2014

Medina Golf and Country Club

400 Evergreen Road, Medina, MN 55340

Host Superintendent: Erin McManus



Advanced turf management theories for the Golf Course Manager.

The MGCSA welcomes Dr. Dave Kopec, University of Arizona, and Dr. Bill Kreuser, University of Nebraska, to discuss the pros and cons of current cultural practices including aerification and topdressing for managing thatch. In the afternoon each will touch upon current projects they are pursuing.

This should be a great day of discussions. Register today.

<i>7:00am - 8:00am</i>	<i>Registration/Networking with assorted pastries and coffee</i>
<i>8:00am - 10:00am</i>	<i>Dr. Dave Kopec: Standard and Specialized Aerification Techniques for Thatch Management</i>
<i>10:00am - 10:15am</i>	<i>Break</i>
<i>10:15am - 12:00pm</i>	<i>Dr. Bill Kreuser: Long Term Topdressing Programs for Thatch Management with Relation to Ball Speed</i>
<i>12:00pm - 1:00pm</i>	<i>Lunch</i>
<i>1:00pm - 2:00pm</i>	<i>Dr. Dave Kopec: ET Driven Irrigation Management with Field Test Catch Techniques</i>
<i>2:00pm - 3:30pm</i>	<i>Dr. Bill Kreuser: Iron Oxide Layers in Sand Based Greens, Winter and Summer Desiccation Prevention and Recovery</i>
<i>3:30</i>	<i>Cash Bar Available</i>

Cost of the Day: \$75 ceu's pending

Education, networking, lunch!

The MGCSA encourages all members to attend this fun event.

It won't be the same without you

Please use Universal Registration form at mgcsa.org

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Wee One Crossing Country Club Tournament Tom Proshek



Personal Protective Equipment (PPE)

October 2014 (Bulletin 5 of 6)

Working with pesticides is hazardous; protect yourself by using appropriate PPE.

Learn your Label

The label provides safety information for product use. Remember, it is a federal violation to not use products as specified on the label.



Example: Label information for;

Trimec Classic herbicide (EPA Reg. # 2217-543)

PERSONAL PROTECTIVE EQUIPMENT (PPE)

All mixers, loaders, applicators and other handlers must wear*:

- protective eyewear*
- long-sleeved shirt, long pants, shoes and socks
- chemical-resistant gloves
- chemical-resistant apron when mixing and loading,

cleaning up spills or equipment, or otherwise exposed to the concentrate.

Applicators may choose not to wear protective eyewear with dilution rates greater (higher) than 5:1 or greater (higher) than 5 parts water to 1 part product.

Financial penalties

Due to potential safety hazards and health risks associated with lack of proper PPE, inspectors will document noncompliance which may result in enforcement and possible financial penalties.

Statutory authority

Follow the link below to read Minnesota Statute 18B.07, Subd. 2. (a) (1)

<https://www.revisor.mn.gov/statutes/?id=18B.07>

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