History – Nematodes and Bentgrass

The first mention of nematodes associated with golf putting greens appeared in 1954, when Troll and Tarjan reported large populations of plant parasitic nematodes were found in diagnostic samples in Rhode Island. In 1963 Illinois researchers conducted the first extensive nematode survey of greens of Chicago and central Illinois. During summer, they found nematode genera of stunt *(Tylenchorhynchus)*, spiral *(Helicotylenchus)*, lance *(Hoplolaimus)*, and ring *(Criconemella)* were frequent residents of sand rootzones **(Figure 2)**. Of those, the stunt nematode was found with greatest frequency and was most numerous compared to other nematodes. Later, in the 1990s extensive investigations of the stunt nematode were conducted in Illinois by Davis, Kane, Wilkinson, and Noel (1994).

FIGURE 2

In the US, the first visible effect of nematodes on bentgrass health was reported in 1970 by southern California researchers. High root knot nematode *(Meloidogyne)* populations were associated with excessive midday wilting of Seaside bentgrass *(Agrostis palustris)* and annual bluegrass *(Poa annua)*. Shortly thereafter, Illinois researchers demonstrated the same root knot nematodes combined with pin *(Pratylenchus)* nematodes reduced Toronto bentgrass shoot growth in the first controlled greenhouse study to demonstrate pathogenicity. In 1972, Laughlin and Vargas showed growth reduction of Toronto bentgrass by stunt nematodes varied according to soil temperature, demonstrating the idea that nematode effects of greens may be seasonal.

Surveys – Nematodes on Putting Greens

Most of what we know about nematodes and turfgrass is only population surveys of sites. From the mid-1970s to the present, many nematode surveys of putting greens were published and represented golf courses in Hawaii, Kansas, New England, New York, North Carolina, Ohio, Oklahoma, and Washington. All showed several phytoparasitic nematodes are common inhabitants of sand-based putting greens. In the 1980s an unpublished survey by Dr. Kane found three nematode species were most common on sand-based greens in Chicago – stunt, ring and spiral **(Figure 3)**. Likewise, a Kansas survey in the 1990s found those nematode species common on greens across the state. In total 11 species were identified, but only high populations of the lance nematode were associated with reduced bentgrass quality at midsummer. In 2000, K-State researchers returned to the question of lance nematodes on bentgrass greens in Kansas. My objective was to determine the pathogenicity of the lance nematode to this host.

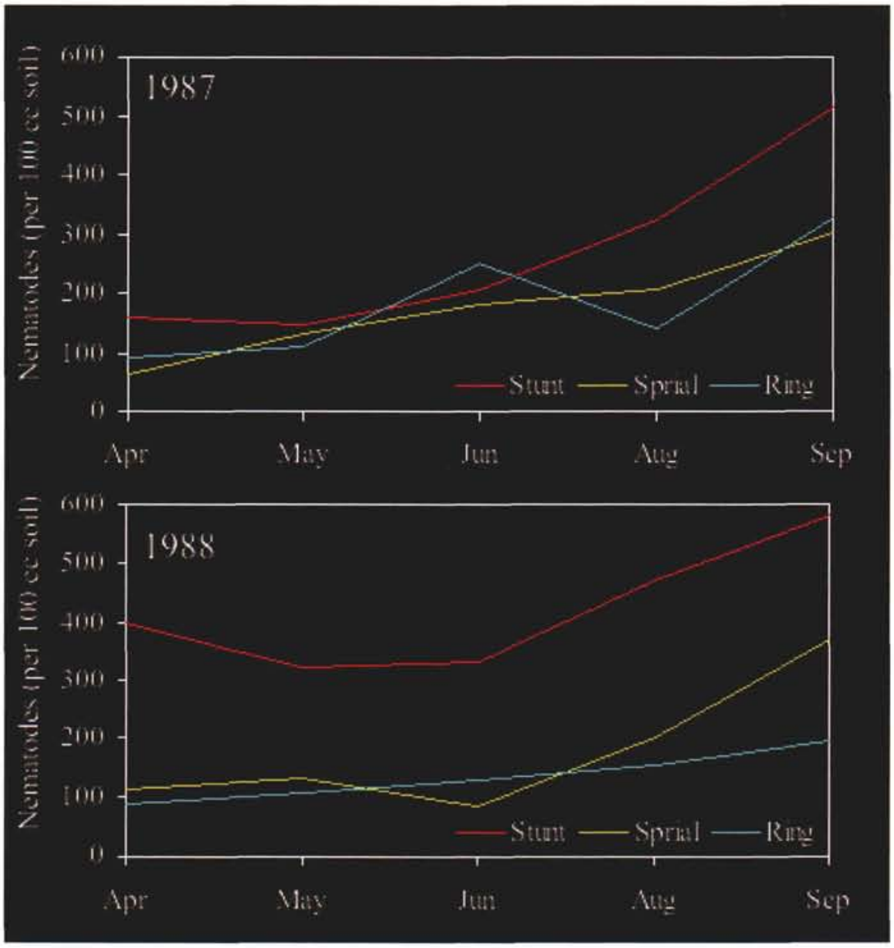

FIGURE 3

In Search of a Population Damage Threshold for Bentgrass

A nematode damage threshold is the number of nematodes per 100 cc soil above which plant health is reduced due to root reduction or dysfunction. Our understanding of populations of root-feeding nematodes that cause damage is lacking, because demonstration of aboveground effects experimentally in the field has proven very difficult. In the greenhouse, multiple turfgrass studies have shown nematodes reduce root weight and length. However, visible canopy effects are difficult to demonstrate; turfgrass is resilient in tolerating a degree of root loss by nematodes. Nematode damage thresholds of turfgrass are confusing because nematology/diagnostic labs typically use different numbers for an individual nematode species. References have compiled nematode damage thresholds to many turf-

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grasses such as creeping bentgrass, and Houston Couch's Diseases of Turfgrasses (1995) is one example. A short coming of estimates for turf-grass injury by nematodes is that they may be derived from greenhouse experiments where conditions are very different from the field.

At Kansas State, my biggest task was to experimentally demonstrate aboveground nematode damage in the field. On an area of A-4 creeping bentgrass, microplots were established to allow introduction of controlled levels of lance nematodes. A microplot was a 12-inch diameter PVC pipe cut so that its length encompassed the entire rootzone from the clay base of the green to its upper surface. Each microplot edge was flush with bent-grass sod and allowed normal green maintenance; clipped at 5/32 inch height six days weekly with a triplex mower (**Figure 4**). Each microplot began as a pasteurized rootzone which was inoculated with of varying amounts of water containing extracted lance nematodes. A total of 20 microplots functioned as nematode

FIGURE 4

cages and the experimental design was a completely randomized block design with five replications. Four increasing levels of lance nematodes existed; 0, 1/2X, 1X, and 2X. Monthly, lance nematodes were extracted from each microplot by light sucrose extraction. During summer, plant health measurements were also taken. Over a period of two years nematode levels in microplots had grown to densities comparable to naturally infested greens **(Figure 5)**.

As previously observed in Kansas, I found visual quality of bentgrass was influenced by lance nematodes at summer. But the level required to reduced visual quality below an acceptable level (0 to 9 scale; with 9 = best, and 6 = minimum acceptable quality) varied monthly, and so a single damage threshold did not exist. Instead, a range of 200 to 1,000 lance nematodes per 100 cc was found capable of causing unacceptable quality of bentgrass during June to September in two years. This range is higher than all previously proposed damage thresholds of lance nematodes on bentgrass.

Currently, published damage threshold levels of the lance nematode of bentgrass are anywhere from 50 to 150 per 100 cc soil. These numbers are too low and only overestimate the pathogenicity of the lance nematode on creeping bentgrass. A better damage threshold would be to use the number of lance nematodes capable of reducing bentgrass quality appreciably. In Kansas, where stressful midsummer conditions are the norm, an average of 400 lance nematodes reduced bentgrass visual quality by10%; a one point reduction on a 0-9 quality scale. This damage threshold is not static and is influenced by bentgrass green health during summer. If overall bentgrass health and quality is high at midsummer, a reduction of bentgrass quality to unacceptable levels by dense lance nematode populations may be avoided. This means golf course superintendents can mask or avoid lance nematode damage by optimizing bentgrass health during summer with certain cultural practices such as midday hand-watering. For example, in a separate study of a naturally infested experimental green, I found a 5/32 inch mowing height maintained acceptable visual quality regardless of lance nematode number unlike the 1/8 inch height **(Figure 6)**. Optimizing irrigation of greens to avoid wilt is another strategy that likely compensates for nematode root damage.

It is important to point out that even when dense lance nematode populations cause unacceptable quality, populations are never uniform across a green. Dense lance nematode populations occur in isolated pockets or aggregates. Therefore, at midsummer only a small percentage of an entire green has the potential to suffer visually. The lance nematode findings in Kansas suggest other ectoparasitic nematodes commonly associated with greens in the Midwest are probably not as damaging as previously thought. Historically, stunt,

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These numbers are too low and only overestimate the pathogenicity of the lance nematode on creeping bentgrass.

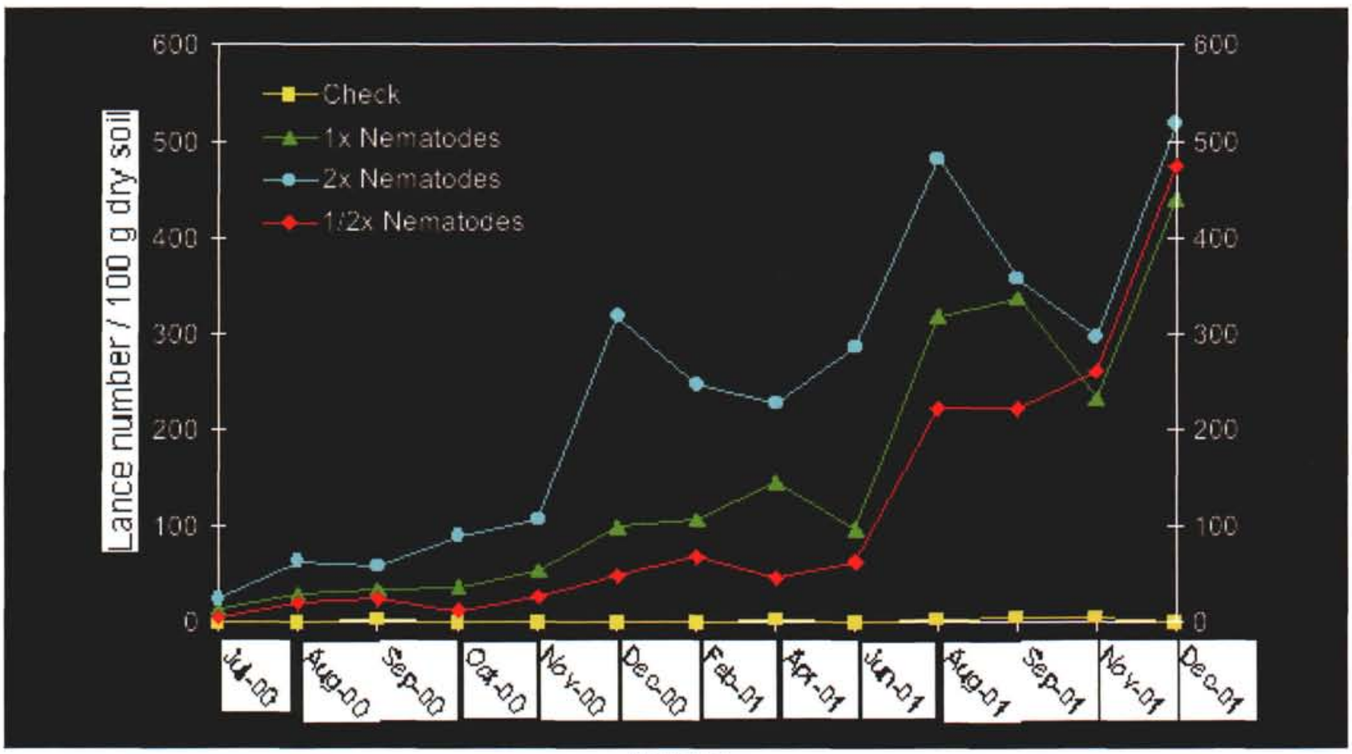

FIGURE 5

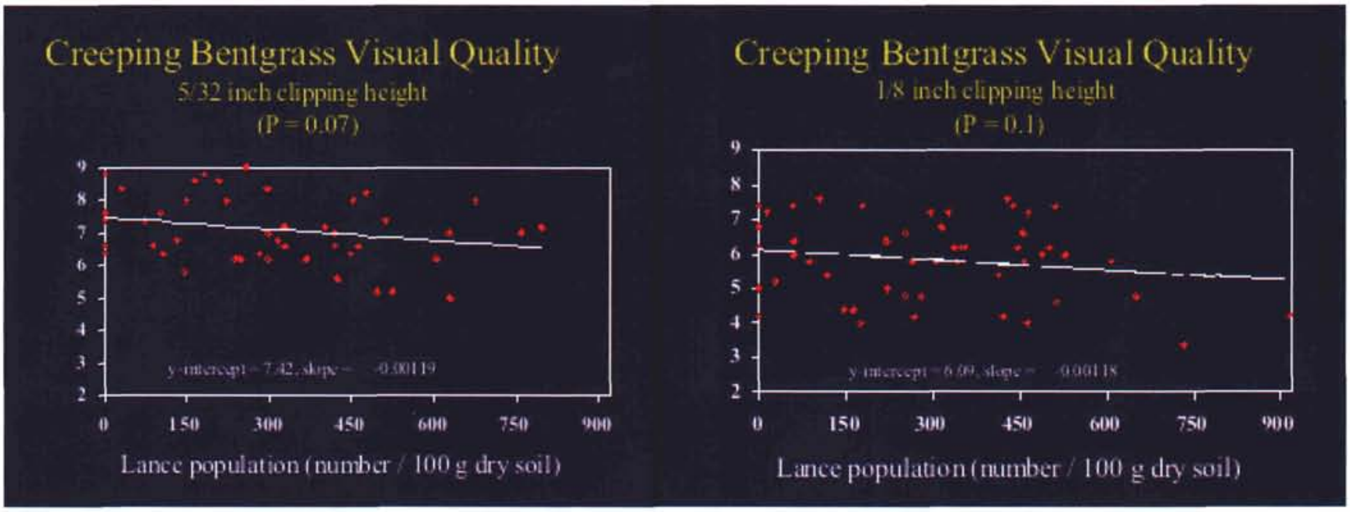

FIGURE 6

ring and spiral nematodes are considered to be less damaging to roots. The lance nematode is not only greater in size and has a large sylet **(Figure 7)**, but was also recently found to preferentially feed as migratory endoparasites of bentgrass roots when juvenile (Settle et al., 2006).

Summary – Nematodes of Bentgrass Greens

In addition to the lance nematode, two other nematodes, the root knot and the cyst, are regarded to be capable of reducing bentgrass health at summer. Root knot and cyst nematodes are sedentary endoparasites of roots and this feeding habit has a greater ability to disrupt root function compared to ectoparasities. A recent survey of golf courses in New England suggests that cyst nematodes may be more common on golf greens than previously thought (Jordan and Mitkowski, 2006). In Chicago, Dr. Kane has found two instances of patchy wilting on greens associated with high levels of cyst nematodes *(Heterodera iri* within *H. avenae* group). In 2006, the CDGA investigated one Chicago site where cyst damage had occurred in the past. The cyst nematodes were still present, but their numbers at summer were low. The importance of the cyst and root knot nematodes on putting green health at summer is poorly understood and further research is warranted.

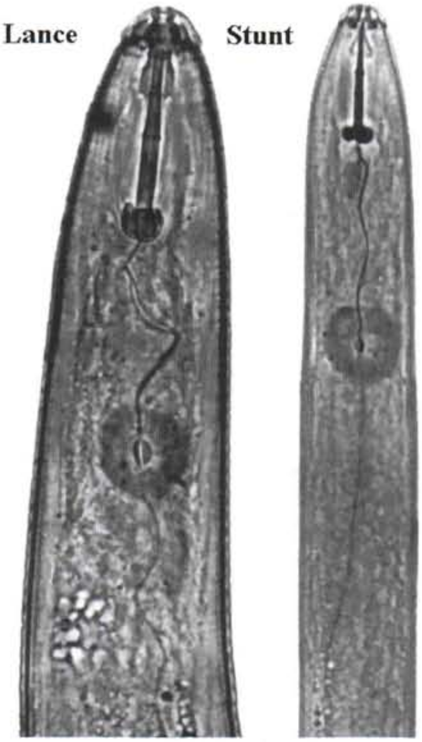

FIGURE 7

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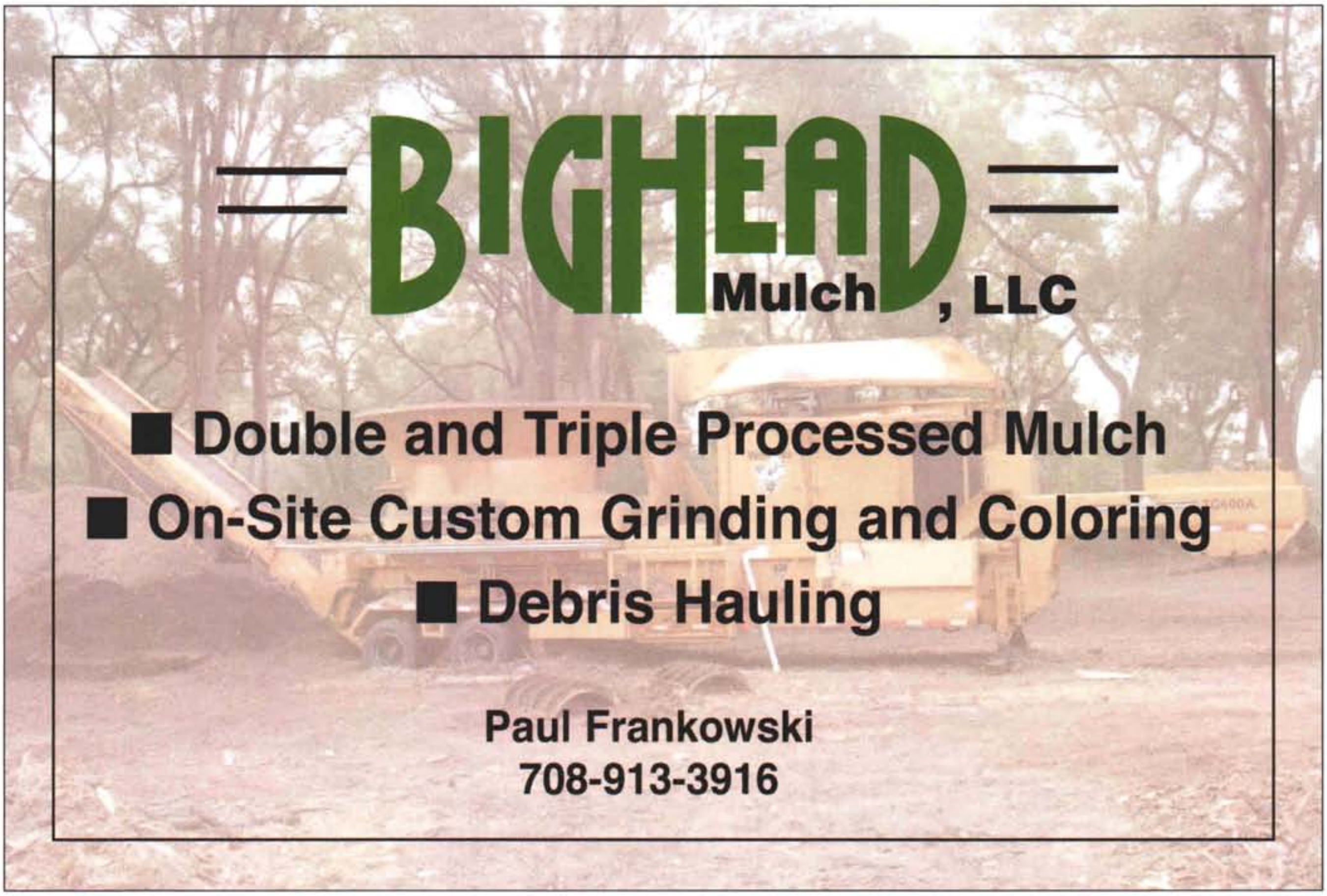
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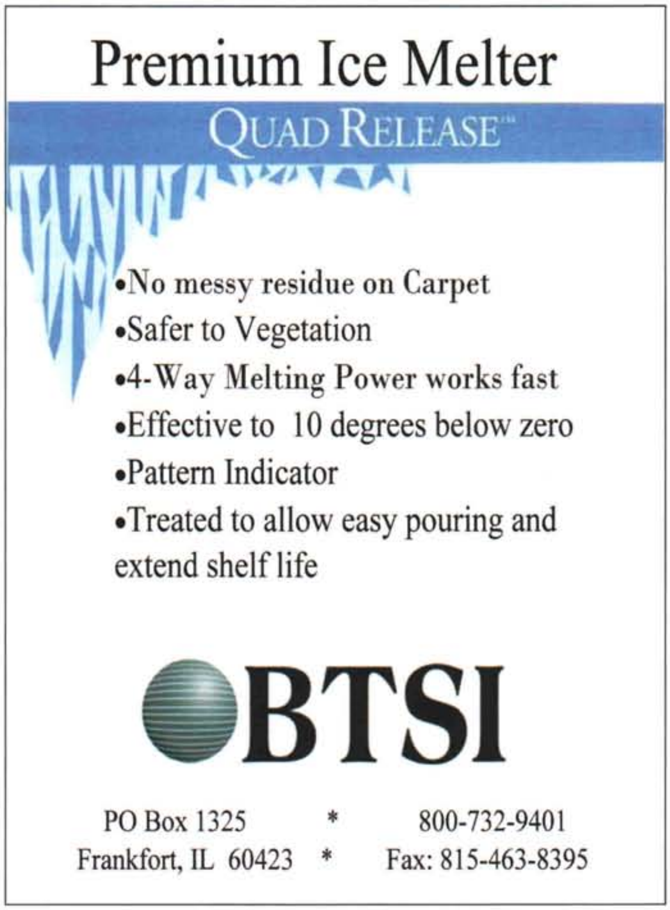
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TECHNICALLY SPEAKING WITH TETA

Wes Danielewicz *Maple Meadows Golf Club*

Was Your Aerator Up To Par?

With fall aerification out of the way, now would be a great time go over those aerifiers to keep them in good working order for the next time you aerate. Let's face it, when it comes down to it, these machines take a beating no matter what we do. They are bound to fail when you need them the most. Although we use aerators infrequently, we still need to do some necessary preventive maintenance on them. Because we use aerators infrequently, we don't know the signs. There are signs that might have given us a clue that a failure was about to happen. So let's see if I could point out some preventive maintenance that could save you from a drastic, untimely, time-consuming breakdown.

Although there are many different brands, models, and types of aerifiers, the one I would like to go over, is the one I know the best, the Cushman GA60.

The first item on the list is to see if the unit will start. If it starts, let it run for a while to warm up a bit.

Preparation

Since these units do not accumulate the designated hours of service, it is a good idea to do the following either before or after each use. Always follow all safety guidelines as described in the operator's manual provided to you by the manufacturer. The first item on the list is to see if the unit will start. If it starts, let it run for a while to warm up a bit. Stop the engine. Drain the engine oil, and remove the oil filter. Don't forget to replace the drain plug after the oil has drained out and before you refill with the correct type and quantity of oil. Check the air filter and the fuel filter; replace as necessary. Check engine coolant, drain if necessary, and replenish with a fresh 50/50 water/antifreeze mix. I prefer the premixed antifreeze; you don't have to worry about mixing it yourself or your water quality.

The ignition system needs to be checked to insure proper operation, especially with the heavy loads required on this unit. I find the best way to inspect the ignition distributor is to remove it from the engine. Inspect the cap, the rotor, and replace if necessary. Check the breaker points (if so equipped) for any pitting or wear. If necessary, replace both points and condenser together. Be sure to adjust the points to the proper gap. Lube the distributor lobes. This helps to prevent premature failure of the point contact arm. Reassemble the distributor and reinstall on the engine. Check the spark

(continued on page 18)

plug wires for fraying or oil-saturated insulation; replace if necessary. Remove the spark plugs and inspect the electrodes for wear, carbon fouling, or breakage of the insulator. Replace if necessary, but, DO NOT CLEAN WITH A SANDBLASTER OR SPARK PLUG CLEANER. Start engine; allow engine to reach operating temperature; check engine ignition timing; and set according to manufacturer's specs.

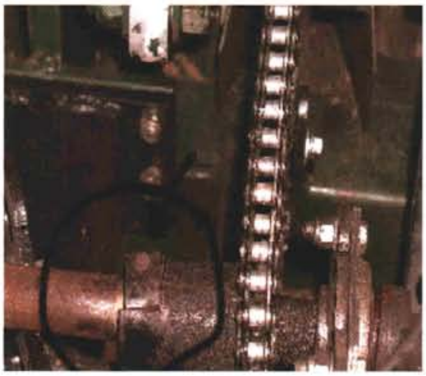
Now that your engine is all tuned up and running properly, you're ready to inspect the aerating head for signs of wear and tear. Begin at the back of the unit where the coring tines are located. On the GA60 there are eight individual arms. Each pair of arms is connected to a reversing gear box. With each of the arms that are connected to one of the gear boxes, pushing and pulling both arms in the same direction will give you an idea of how much play, if any, is in that specific gear box. If too much play is evident, it's time to remove that gearbox and rebuild it or replace it.

The next item is to see if there is any bearing or shaft wear in the upper end of the coring head. This will include the crank arm and all connecting parts. The way to test this is by placing a 2x4 piece of lumber under the coring tines and gently lifting up on them. If any movement is felt, you can bet that there is a worn bearing, shaft, or both. It will be necessary to make any repairs before going on with the inspection.

Next move back into the engine compartment. Check the drive chains for wear, damage, and proper tension. If there is any wear or damage evident, you will need to replace the drive chain. A simple kink or twist in the chain can cause severe damage to all sprockets associated with that chain. Chain tension is important because a loose chain will cause a slapping motion that, in turn, will cause damage to the chain and sprockets. A chain that is over tightened can break and cause damage due to heat-build-up during operation. It is important to operate the machine with the proper chain tension.

A chain with a damaged link.

When checking the drive chains, it's a good time to check the chain sprockets. It's easiest to detect damage to the idler sprocket because it is made of a composite, plastic material. If it has any damage on it you will know it. The drive sprocket, which is the smaller of the remaining two sprockets, can have damage, not only on the teeth, but also on the area that clamps to the jackshaft. It's important to look closely. Be aware that the slightest crack in this area is an indication of an eventual failure. It should be replaced immediately.



The driven sprocket, which is the largest on the coring head assembly, is best checked by removing the drive chain. While the chain is removed, it's easy to check the bearings in the sprocket support housings. Finding damaged teeth on the sprocket demands immediate replacement.

A sproket with damaged teeth.

Once the chains, sprockets, and bearings have been checked and everything is restored to good, or better than, condition, check the coring-head timing and adjust as necessary. To do this, you will need to follow the procedures in the service manual. Don't forget to lube the drive chains with a good quality chain lube.

The next item to check is the slip clutch. The slip clutch is part of the large pulley (See figure A) that is connected to the jackshaft, which drives all the chains and sprockets. The pulley is driven by a belt connected to a drive-unit off the engine. The components of the slip clutch consist of the pulley, two friction plates, a friction disc, springs, and the spring plate (See figures A-C).

Figure A

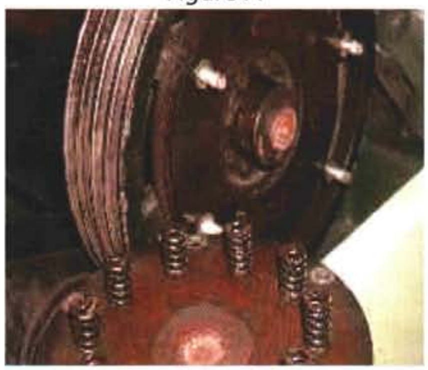


Figure B

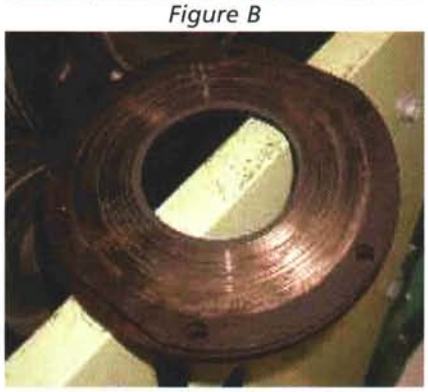


Figure C

Remove the drive belt and inspect for damage; replace if necessary. Remove the spring plate, friction plate, disc, and the other friction plate. The plates should be cleaned up with a steel wool pad. Check the friction disc for wear, and replace if needed. To ensure proper operation, replace the plates and disc if any scoring is evident. Speaking of operation, the way the slip clutch works is this: if you were to come across a hard solid object, such as concrete, and try to aerate it, the slip clutch would sense this, and cause the clutch to slip, thus preventing either severe damage to the coring head or knocking the timing out of adjustment. That's why it's important to maintain this mechanism.

Once the slip clutch disc and plates have been cleaned, spray a little WD-40 on the surface to help prevent rust. Install the springs, spring plate, and flange nuts. Tighten the nuts to the specification length of the springs as shown in figure D. Reinstall the drive belt. Adjust the spring tensioner according to the specifications found in your service manual.

Now that you've looked at most of the major portions of the machine, there are just a few more items that should be checked. Check the clutch and governor for proper adjustment. The turf guards should be adjusted so that the coring tines clear the fingers. Last but not least, it's necessary to lube all grease fittings on the machine. The coring-head axle fittings should be greased with the coring-head down. If you don't have a lift to raise the machine up off the ground, it would be a good idea to remove the tines before lowering the unit. Lowering the unit relieves pressure and allows the grease to flow freely.

A good coat of wax on the sheet metal will keep that machine looking new for a long time to come. Happy aerating!!!

... if you were to come across a hard solid object, such as concrete, and try to aerate it, the slip clutch would sense this, and cause the clutch to slip, thus preventing either severe damage to the coring head or knocking the timing out of adjustment.

the Bull Sheet

John Gurke, CGCS, Associate Editor

DATES TO REMEMBER

December 4 – Annual South Side Holiday Party at Chef Klaus Bier Steub in Frankfort, IL beginning at 11:30 AM.

December 7 – GCSAA live webcast "Why Doesn't Everyone Use Environmentally Preferred Products?" at 10:00 AM.

December 11 – Annual West Side Holiday Party at Dave & Buster's in Addison, IL. As in previous years, education points have been applied for; and as in previous years they have been denied.

December 14 – GCSAA live webcast "Animation and Presentation Tips for PowerPoint Users" at 2:00 PM.

December 20 – GCSAA live webcast "Environmental Risk Assessment" at Noon.

January 10 – MAGCS Chapter-Administered GCSAA seminar LIVE at Midwest Golf House in Lemont, IL. Dr. Fred Yelverton will present "Taking Control of Your Grassy Weeds."

January 23 – MAGCS monthly meeting at Rich Harvest Links in Sugar Grove, IL with **Scott Resetich, Jason Funderburg**, and **Jeff Vercautren** hosting.

January 26 – Deadline for qualified applicants to register to take the certification exam at the GCSAA Education Conference in Anaheim.

February 8 – Annual Assistants Winter Workshop at Midwest Golf House in Lemont, IL.

February 19 – 24 – GCSAA Education Conference in conjunction with the Golf Industry Show in Anaheim, CA.

February 22 – MAGCS Hospitality Suite at the Hilton Anaheim from 6:00 to 10:00 PM.

To kick things off in this last issue of 2006, let's give our congratulations and thanks to those who have earned it for their accomplishments and for their service relating to our great organization.

Thank you to all the members of our Board of Directors for their dedication and commitment—President **Gary Hearn**, Vice President **Tim Anderson**, Secretary/Treasurer **Dave Braasch**, Past President and Bylaws/Nominating and Benevolence chair **Phil Zeinert**, Arrangements chair **Todd Schmitz**, Education chair **Tony Kalina**, Golf chair **Paul Bastron**, Editorial chair **Scott Witte**, Advocacy and Compliance chair **Tom Prichard**, Membership chair **Dan Sterr**, Class C Advisor **John Ekstrom**, Commercial Advisor **Sharon Riesenbeck**, and Past Presidents Council chair **Ed Braunsky**. Congratulations and best wishes to incoming president Tim Anderson and the entire Board, including new meat **Harry** (don't call him Caray) **Lovero** of Orchard Valley Golf Club. Let's take that a step further and give our thanks to the many committee members whose generosity with their time and expertise made the year fly by so smoothely.

And how 'bout that **Luke Cella**, huh? We should all be thankful to have this guy—the hub of this wheel called MAGCS to which all spokes lead. I wish I could take credit for that metaphor, but alas, it was Gary Hearn's eloquent description.

And let us not forget our esteemed scholarship winners for 2006—best of luck in your promising futures to Alicia Anderson (John & Debbie), Scott Healy (Tom & Connie), Sarah Matchen (Mike & Sue), and Stephanie Meier (Joe & Joanne).

Thank you to all of our sponsors throughout the year who have made it possible for our monthly events to be voted "Best Monthly Events" by Monthly Events magazine (if there were such a magazine with such an award, our sponsors would DEFINITELY be responsible for it).

Special thanks to Mark Karczewski, the "man behind the curtain" that we pay no attention to, but whose expertise consistently provides us with this top-quality magazine from month to month and year to year. Mark is TRULY a wizard. [Publisher's Note: Ditto, ditto, ditto, thanks Mark.]

Finally, thank you to YOU—the people reading this who make up the Midwest Association of Golf Course Superintendents—for your continued participation and support of our association.

MAGCS welcomes its newest members to the fold with hopes that your expectations are exceeded and your careers are enhanced through your membership:

Brice Denton, Great Lakes Turf—Class E.
Michele Dileto, BTSI—Class E.
Chip Houmes, Precision Laboratories—Class E.
Timothy W. Nixon, Ruth Lake Country Club—Class C.
Andrew D. Perry, Cress Creek Country Club—Class C.

One of our colleagues has been discovered rubbing elbows with the high-falutin' club and resort crowd. **Dan Dinelli, CGCS** (North Shore CC), amongst his countless other talents, has been a frequent contributor to *Club & Resort Business* magazine this past year in its

(continued on page 22)