Golfdom'S PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

TURFGRASS TRENDS

FERTILITY AND STRESS

Fertility Optimization Vital to Help Turf Recover From Traffic

By J. S. Ebdon, L. Hoffman and M. DaCosta

Turfgrass function and quality are affected by wear and soil compaction, the two major components of traffic stress. With increased traffic, there's an increasing need for fertility programs that maximize wear tolerance and recovery under intensely trafficked conditions.

Perennial ryegrass is commonly used on golf courses grown in cool-season climates because of its excellent wear tolerance. Nitrogen (N) and potassium (K) are frequently applied nutrients to golf courses, but little is known about their influence on wear tolerance and recovery.

There has been little agreement from species to species as to the optimum N and K levels for achieving maximum wear tolerance. Optimum N for maximum wear tolerance varies with the species.

Increased shoot density with N provides more tissue (cushioning or resiliency) available to absorb the impact of the injury caused by wear. Nitrogen can promote an increase in wear tolerance up to some critical threshold beyond which wear tolerance can decrease. In perennial ryegrass, optimum N when applied alone following wear was found to be about 4.5 pounds of nitrogen per 1,000 square feet per year.

In recent years, there has been a trend by practitioners towards applying relatively high rates of K equal to or exceeding N. The effect of K, however, on overall wear tolerance is unclear. Wear tolerance in creeping bentgrass increased with K with the largest increase in wear tolerance occurring with 5.5 to 7.5 pounds of K per 1,000 square feet per year. However, numerous studies have reported no effect of K on wear tolerance.

This lack of agreement as to optimum fertility may be because of the effects nutrients have on turfgrass growth when applied alone. They can be distinctly different when applied in various combinations with other major nutrients.

Accordingly, wear studies investigating N applied alone may have little relevance to N applied in combination with K. The objectives of this research was to compare the effects of N and K on wear tolerance and recovery in perennial ryegrass

N and K treatments

This study was conducted at the University of Massachusetts Amherst, Joseph Troll Turf Research and Education Center (South Deerfield, Mass.). Perennial

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ryegrass (Brightstar) was established Aug. 4, 2004, and fertilized using 15 N-K treatments that were initiated in April 2000. The N-K treatment combinations included five rate levels of N (1, 3, 5, 7 and 9 pounds per 1,000 square feet per year) with urea (45-0-0) as the sole source of N.

Potassium sulfate (0-0-50) was used as the sole source of K and was applied at three rate levels (1, 5 and 9 pounds per 1,000 square feet per year) in all combinations with N. Treatments were arranged as a randomized complete block design with four replicates.

Monthly fertilizer applications are generally applied during the last week of each month. Approximately 60 to 70 percent of the total annual N was applied during the fall period from late August through late November. Applications made in November were applied after the last mowing when shoot growth had ceased.

Treatment plots were 5 feet by 10 feet and were mown twice per week at 1.25 inch height of cut using reel mowers. Clippings were returned except when collections were made for growth determinations. A total of four clipping collections were made in each year of 2006 and 2007, which included the months of May, June, September and October.

May and June collections were averaged and represented spring yields while September and October averages represented fall growth rates. Clippings were oven dried at 70 degrees Celsius for 48 hours, weighed and expressed as grams of dry weight per meter per day.

The wear simulator used was a differential slip-wear (DSW) machine developed according to the design by the Sports Turf Research Institute. The wear simulator was designed to create a scuffing action, while minimizing pressure to the soil, therefore limiting soil compaction.

A cumulative total of 150 passes were applied on June 22 and June 23, 2007. Recovery was rated at two weeks after treatment (2WAT), 4WAT, 8WAT, 12WAT and 16WAT following DSW in 2006. In 2007, recovery ratings following DSW are reported at 2WAT, 4WAT, 8WAT, 12WAT and 14WAT.

Ratings for wear tolerance and recovery following DSW were visually recorded as the percentage of surface covered by green vegetation after wear treatment using a scale of 1 to 9 (9 = no injury or 100 percent green cover, 1 = no green vegetation).

In studies, 1 pound N per 1,000 square feet per year (shown to the left) was adequate for wear tolerance, but shoot growth and recovery from wear was too slow. Conversely, 9 pounds of N per 1,000 square feet per year (shown to the right) following simulated wear was excessive and caused significant wear injury. But shoot growth and recover was rapid. Optimum N for wear tolerance and recovery in perennial ryegrass is about 5 pounds of N per 1,000 square feet per year.

Results and discussion

Potassium had no effect on wear tolerance, which is in agreement with other wear studies using DSW or rollers.

The effect of N, however, accounted for about 95 percent of the variation in wear tolerance in 2006 and 2007. Nitrogen caused a significant reduction in wear tolerance in June 2006 and 2007 when perennial ryegrass was fertilized at rates exceeding 5 pounds of N per 1,000 square feet per year.

A 40-percent reduction in wear tolerance was observed as N increased beyond 5 pounds N per 1,000 square feet per year. These results are in contrast to reported optimum N rates for wear tolerance in other species (10, 11), which are above the 5 pounds

Shoot growth accounted for as much as 94 percent of the variation in wear tolerance. Wear injury and shoot growth rate increased with increasing nitrogen, especially when fertilized in excess of 5 pounds of nitrogen per 1,000 square feet per year.

N per 1,000 square feet per year optimum for perennial ryegrass in this study.

Perennial ryegrass is known to be more responsive to fertilizer N; greater leaf growth response is observed with each incremental increase in N applied. Excess shoot vigor and growth can reduce wear tolerance and deteriorate faster under wear. A greater increase in growth and vigor by perennial ryegrass per unit of N applied may account for this species' lower N requirement for optimum wear tolerance. Perennial ryegrass fertilized with N rates ranging from 1 to 5 pounds N per 1,000 square feet per year exhibited less visible wear injury than plots receiving 7 and 9 pounds N per 1,000 square feet per year.

Recovery ratings in perennial ryegrass in response to N were distinctly different from wear tolerance ratings following DSW in 2006 and 2007. Higher N rates promoted greater recovery compared to 1 and 3 pounds of N per 1,000 square feet per year.

By 8WAT, the 5 pounds of N per 1,000 square feet per year rate was statistically superior during recovery than all other N rates, particularly in 2007. By 12WAT in 2006 and 8WAT in 2007, all K combinations fertilized with 5 pounds of N per 1,000 square feet per year were statistically equivalent to non-wear checks, according to the LSD (0.05) value (i. e., equal to 9 on the 1 to 9 rating scale). The 5 pound N per 1,000 square feet per year rate was the first N-K treatment combination to achieve full recovery in 2006 and 2007.

Unlike N, K was generally not important in recovery. Better recovery promoted by N is due to greater vigor and shoot growth exhibited by perennial ryegrass in response to N.

Shoot growth accounted for as much as 94 percent of the variation in wear tolerance. Wear injury and shoot growth rate increased with increasing N, especially when fertilized in excess of 5 pounds of N per 1,000 square feet per year. Like shoot-growth rate, perennial ryegrass shoot density in our studies increased with N at rates above 5 pounds per 1,000 square feet per year.

However, higher N comes with diminishing returns as greater shoot growth (and density) can promote greater wear injury in perennial ryegrass. Practices that promote significant increases in shoot growth or tissue moisture may be especially detrimental to wear tolerance in perennial ryegrass. Optimum N for maximum wear tolerance and recovery in perennial ryegrass is about 5 pounds of N per 1,000 square feet per year.

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REFERENCES

Adams, W.A., P.J.Bryan, and G.E. Walker. 1974. Effects of cutting height and nitrogen nutrition on growth pattern of turfgrasses. p. 131-144. In E. C. Roberts (ed.) Proc. 2nd Int. Turfgrass Res. Conf., Blacksburg, VA. 19-21 June 1973. ASA and CSSA, Madison, WI.

Canaway, P. M. 1976. A differential slip wear machine (D.S.1) for the artificial simulation of turfgrass wear. J. Sports Turf Res. Inst. 52:92-99.

Canaway, P. M. 1985. The response of renovated turf of Lolium perenne (perennial ryegrass) to fertilizer nitrogen I. Ground cover response as affected by football-type wear. J. Sports Turf Res. Inst. 61:92-99.

Carroll, M. J., and A. M. Petrovic. 1991. Wear tolerance of Kentucky bluegrass and creeping bentgrass following nitrogen and potassium application. HortScience 26:851-853.

Carrow, R. N., and A. M. Petrovic. 1992. Effects of traffic on turfgrass. p. 285-330. In Turfgrass (eds.) D. V. Waddington, R.N. Carrow, and R. C. Shearman. Agronomy Monogr. 32. ASA, CSSA, and SSSA, Madison, WI.

Christians, N. E., D.P. Martin, and J. F. Wilkinson. 1979. Nitrogen, phosphorous and potassium effects on quality and growth of Kentucky bluegrass and creeping bentgrass. Agron. J. 71:564-571.

Ebdon, J.S., A. M. Petrovic, and R. A. White. 1999. Interaction of nitrogen, phosphorous, and potassium on evapotranspiration rate and growth of Kentucky bluegrass. Crop. Sci. 39: 209-218.

Hawes, D. T., and A. M. Decker. 1977. Healing potential of creeping bentgrass as affected by nitrogen and soil temperature. Agron. J. 69:212-214.

Shearman, R. C., and J. B. Beard. 1975a. Turfgrass wear mechanisms: I. Wear tolerance of seven turfgrass species and quantitative methods for determining wear injury. Agron. J. 67:208-211.

Shearman, R. C., and J. B. Beard. 1975b. Influence of nitrogen and potassium on turfgrass wear tolerance. Agr. Abstr. p. 101.

Trenholm, L. E., R. N. Carrow, and R. R. Duncan. 2001. Wear tolerance, growth and quality of seashore paspalum in response to nitrogen and potassium. Hortsci. 36(4):780-783.

Safe Harbor

Golf courses can help reduce amphibian population declines. Here's how

By Michelle D. Boone

The ponds at Hueston Woods, Golf Course in Oxford, Ohio, are a good example of managing habitat both for golf and amphibians.

PHOTO BY: EDWARD RAMERIZ

If all the world's a stage, most North American amphibians play out their dramas at the pond's theater. It's a story of romance (courtship) and action (adventures, securing dinner), where the likelihood of the individual surviving to the end of the story is just 1 to 5 percent because of predators, competitors and environmental factors like drying ponds.

In the last decade, however, it has become clear that amphibians face even bigger problems in their native habitats — populations are declining at alarming rates and amphibians are now the most endangered group of vertebrates on the planet with about one-third at risk to extinction. The No. 1 cause of these declines is habitat destruction and alteration. Solving this problem will take creative solutions, particularly as the world human population continues to grow. Solutions, however, are possible and have the potential to provide a win-win situation for both wildlife and humans, in ways that may represent no or minimal costs to humans.

Golf courses are green spaces with the potential to be one part of the solution in providing habitat for amphibians and other species, because many golf courses have habitat that mimic natural environments of pond-associated species. Because there are more than 16,000 golf courses in the United States with an average size of 150 acres, there's the potential that golf courses could have a large positive impact on biodiversity.

Golf courses are designed, built and managed so that people can golf, not so that one of the world's most fascinating taxonomic groups can breed and develop. So why should superintendents or anyone bother to make changes that benefit amphibians?

First, all adult amphibians are insect-eating machines that can naturally manage insect populations to tolerable levels. Salamander larvae will also feed on the aquatic larvae of insects like mosquitoes and will keep those populations in check.

Second, most tadpoles are herbivores that feed on algae and improve the water quality of a pond — another free service that doesn't require the time and costs associated with stocking ponds with fish (which are lethal predators of most amphibians).

Third, amphibians are ectothermic, which makes them extremely efficient at transforming nutrients into body mass, thus making them an important component of the food web as prey for mammals, birds and reptiles. Studies also demonstrate that a presence of frogs resulted in greater plant growth from reducing insect abundance and from nutrient output from the digestive process.

Ways to welcome amphibians

Native amphibians are abundant in many habitats, can colonize new ponds and can use habitat created by humans if a few conditions are met. Studies with amphibians, including some of our recent research with amphibians on golf courses offer a few management strategies:

No. 1 — Eat Fish But Do Not Add Them to Your Ponds: Amphibians have their lowest diversity and abundance in ponds that contain fish. In a study with northern cricket frogs and green frogs raised with either bluegill, triploid grass carp or crayfish, the presence of either bluegill or carp essentially eliminated both amphibian species. Even herbivorous fish like carp can be lethal to amphibians, so stocking any fish is detrimental to most amphibians.

No. 2 — Let a Little Grass Grow: Most North American amphibians have complex lifecycles with an aquatic larval stage and a terrestrial juvenile and adult stage. Therefore, to maintain populations, adequate aquatic and terrestrial habitats are both needed. Most golf courses have ponds that could be suitable for native amphibians, but the management around the pond will make it or break it for amphibians.

First, amphibians need unmown grass or forest habitat (depending on the species) because these areas harbor food resources, and offer a refuge from predators and desiccation. Desiccation represents a major risk for amphibians. Without moist soil or a water source, amphibians can die of dehydration in 24 hours or less.

In our studies, we have found that northern cricket frogs prefer to hang out in unmown grass (over mown grass) where they lose less water and where food is abundant. Leaving a portion of the pond unmown or forested can be beneficial to amphibians and allow them to complete their lifecycles. In this way, an area that's out of play can return to a more natural state, which will provide habitat for amphibians, butterflies and plants — a benefit to wildlife, while reducing maintenance costs.

Second, terrestrial buffer zones (or areas left unmown or forested by a pond) can reduce contamination of wetlands by absorbing fertilizers and pesticides as they move through the soil.

Research shows amphibians can survive larval development at least as well in some golf course ponds as in protected wetlands. It also suggests amphibians can tolerate some level of contamination and that surrounding the pond completely with a buffer zone may not be necessary so the right of play can be balanced with wildlife needs.

No. 3 — Water is Life, Especially in Spring and Summer: The greatest diversity of amphibians is in temporary pond communities — ponds that fill in the fall or winter and dry in the late summer or fall, or dry every other year. Regular drying in late summer or fall reduces insect and fish predators, which benefits amphibians. Maintaining water in the spring and summer will help amphibians produce many juveniles that can feed on insects in the terrestrial environment and will return in subsequent years to maintain the population with a new crop of eggs. Drying ponds in the fall for pond or fountain maintenance can actually help amphibians.

No. 4 — Stay Connected: Few pond-breeding amphibians travel more than a half mile and most will not move more than one-tenth of a mile in their lifetimes. Placing ponds close enough to streams or other ponds within or outside the course when designing courses will increase the likelihood a pond will become colonized by local amphibians.

Healthy populations

There's little superintendents need to do to attract amphibians aside from having both appropriate aquatic and terrestrial habitats. Improving the chances for healthy amphibian populations most often involves not doing: not adding fish, not drying ponds in spring or summer and not mowing around the whole pond.

In studying the effects of buffer zones on aquatic and terrestrial life stages of amphibians, the superintendents we've worked with have been extremely helpful and some have been delighted to leave areas unmown for our research because it saved on maintenance costs. One golf course had signs in some unmown areas noting these "Wildflower and Wildlife Areas," which improved public perception of their management.

Sharing the positive strides that your golf course is taking to benefit wildlife will be attractive to many golfers as public awareness of the biodiversity crisis rises. Recreational activities do not have to come at a great cost to wildlife and golf courses have the potential to lead the way in wildlife-compatible development.

Golf courses have the potential to be part of the solution in providing habitat for amphibians.

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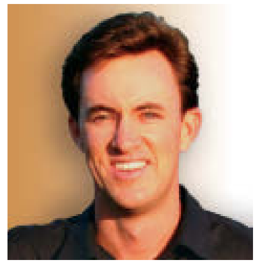
Of Tiger's Tale

GOLF WILL NOT TAKE A HUGE HIT FROM TIGER WOODS' DOWNFALL. THE SPORT MIGHT EVEN BENEFIT IN WEIRD WAYS

BY GEOFF SHACKELFORD



Tiger Woods is bigger than the game. Or so we've been told for the last decade.

So when his SUV crashed into his neighbors' tree, an accident that unleashed a barrage of tabloid stories, a sad and bewildered golf industry assumed the worst: The sport was doomed without its flagship.

I say, not so fast.

If you could turn back the clock and return life to the pre-Nov. 27, 2009, state of affairs, it would be a no-brainer, right?

Not exactly.

Golf will not take a huge hit from Tiger's downfall. The sport might even benefit in weird ways.

Consider what Tiger has done for the game and the golf industry. Yes, PGA Tour purses have climbed, television ratings have soared (at times) and best of all, Tiger delivered a cool factor that attracted all generations. Here was a passionate, successful and athletic man from something other than the white-bred world erasing many stereotypical images in a sport thought to be inhabited by several million Judge Smails.

But has the sport really changed for the better since Tiger turned pro in late 1996? Aren't there still a bunch of Smails running around trying to protect the elites' warped stance that golf is a sport for the privileged? And aren't these the same elite who are often determined to cling to wasteful and empty values like wall-to-wall turf, 50,000-square-foot clubhouses and ornamental nonsense that only adds frivolity to a sport in need of more sensible direction?

Tiger allowed the corporate world to openly embrace golf, but that came with demands for a golf experience light on value and heavy on experiential theatrics, which did little to grow the sport.

Worse, there was a growing sense both within and outside the golf world that it was business as usual, with Tiger paid lavishly to enable elites to highlight the sports' diversity when all they really wanted to do was hide behind an illusion and protect some imaginary cult of the establishment.

The number of golfers has remained stagnant during Tiger's career, and while there's no doubt that more kids are interested in golf, the opportunities for them remain limited despite programs like The First Tee.

Only now in a Great Recession are public courses offering better deals. Clubs with little concern about the future are now offering affordable membership opportunities as the next generation has been struggling for reasonable access to courses. But equipment is more expensive than ever.

If you're under the age of 30 and not living off of someone else, golf is still not a very welcoming sport. And maybe it never will be, but the last 14 years of Tiger's reign certainly didn't do much to make an impact.

There's little doubt the industry asked a lot of Tiger and perhaps that burden helped fuel his extreme behavior. Mercifully, that weight is now gone and the sport will never ride his coattails like before. From the PGA Tour to the everyday muni, golf will have to thrive on its playing values, increased affordability and its timeless strength as the most unique recreational sport known to man. And with looming water issues and calls for environmental compatibility, the industry will have no choice now but to act more sensibly.

Oddly though, Tiger has created an opportunity. Woods' accident gave golf a bizarre kind of mainstream appeal that didn't exist before the accident. In the aftermath of Woods' downfall, the world of golf has been part of the national conversation. Suddenly, we're part of something huge, something real and something worth paying attention to.

It took a wacky Shakespeare-meets-Dickens-in-the-vein-of-Quentin Tarantino boondoggle to make that happen.

What a weird world we live in.

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