Sports Turf Manager
FOR BETTER, SAFER SPORTS TURF. SUMMER 2015. VOL. 28. NO. 2.

Fairy Rings are Magical

Tom Hsiang, Ph.D., Professor and George Barron, Ph.D., Retired Professor
Environmental Sciences, University of Guelph

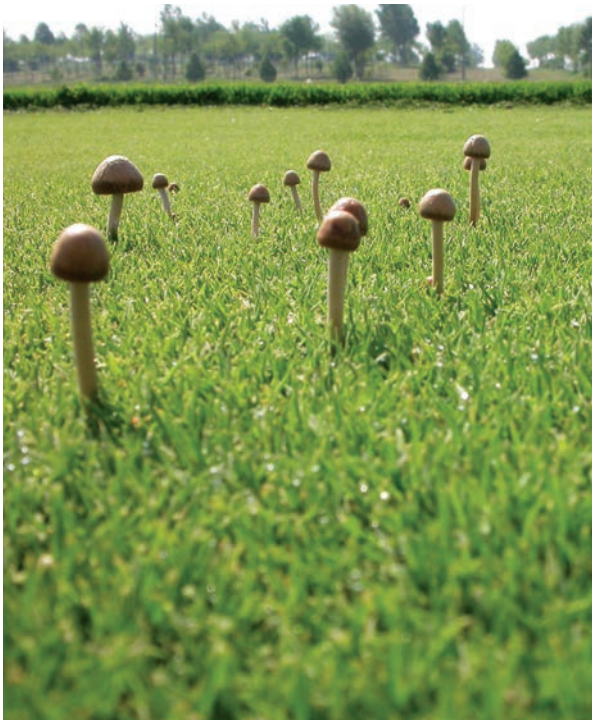

Figure 1

Fairy Rings are magical. Or so it was believed by people in olden times. What they saw was the seemingly magical appearance of mushrooms virtually overnight. They then superstitiously linked this to the dancing of mythical creatures in circular patterns at night. We now know that they indeed are magical, and grow stealthily in the thatch or buried woody material, and sprout to spread their spores on the wind (Figure 1). They are often circular because they grow outwards from a central start point, and only produce mushrooms or other symptoms (dead ring or stimulated ring) at the outer edge of the ring. The fungus in these rings is only active at the outer edges and will have died off in the centre. If left undisturbed, the rings can continue to grow to be metres across.

Most mushrooms are soft, delicate and sensitive to drying, and they don't care for exposed habitats. They prefer the deep, dark recesses of the forest. In the woods, there is abundant organic debris they can use for food, and it stays damp for long periods under the canopy. Also, there are some fungi which are associated with tree roots, and they appear annually in a ring around the tree (Figure 2). These fungi are mycorrhizal and live in symbiosis with the tree, by providing the tree with nutrients and perhaps providing protection against root-attacking organisms, and obtaining photosynthates from the tree.

Fungi like it wet, and wide open grassy places are exposed to the sun all day, therefore, are not among the favourite spots for fungi to set up shop.

(continued on page 6)

Inside Features

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328 Victoria Road South
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Tel: (519) 763-9431
Fax: (519) 766-1704
E-mail: info@SportsTurfCanada.com
Web: SportsTurfCanada.com

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EDITORIAL COMMITTEE
Ken Pavely, Ben Tymchyshyn and Lee Huether

PUBLISHER
Jackie Ranahan
Mach One Communications
Tel: (519) 846-0446
E-mail: jackie@thinkmachone.com

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President's Desk

BY TENNESSEE PROPEDO

Well things are sure heating up here at Sports Turf Canada™ and in Canada in particular.

The FIFA Women's World Cup has now commenced, wrapping up on July 5. Venues right across the country will be hosting this prestigious tournament being the first FIFA-sanctioned event ever to be played on synthetic turf. Approximately one week later the spotlight is back on when the 2015 Pan Am and Parapan Am Games will be held in Ontario. The Golden Horseshoe area has been selected as the host with venues spread out all along the shoreline of Lake Ontario. World class athletes from the America's will be descending into the region with highlights including boxing, track and field, volleyball and soccer which will be hosted in my hometown of Hamilton.

With all this going on Sports Turf Canada is pleased to announce the 2015 Sports Turf Manager of the Year. Read about this in the inside pages of the magazine to find out who the recipient is, if you don't know already! Remember members, we are now in the process of accepting applications for the 2016 award. As a "grass roots" organization you needn't be working in a large municipality or high profile facility to be worthy; Sports Turf Managers affect their workplaces, communities and the industry in many different ways.

Finally Sports Turf Canada has a full slate of educational events to roll out this year. Field days are scheduled for Atlantic Canada and Ontario and we await news from the west. The next Synthetic Sports Turf Field Safety & Maintenance Course is scheduled for September in Hamilton ON, with the option to obtain accreditation with the Clegg Hammer, Triax A-Missile and infill depth testing devices. The City of Toronto hosted our first accreditation event, putting eight of their team through their paces. They were joined by staff from the municipalities of Barrie, Oakville, South Huron, St. Catharines, the Hamilton-Wentworth Catholic and Waterloo Region District School Boards and Nustadia Recreation.

Check our Events Calendar online at sportsturfcanada.com for details of these and other educational and networking opportunities as they are confirmed.

Thanks and hoping everyone has a great summer!

Tennessee

(L to R) Roy Drysdale/ Hamilton Wentworth Catholic District School Board, John Bellehumeur/ City of St. Catharines, Mark Nicholls/TURFIndustry, Joe Breedon/ City of Barrie and Paul Gillen/Sports Turf Canada at the synthetic sports turf field safety accreditation event May 7 in Toronto ON.

New & Returning Members

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City of Penticton, BC

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Rosa Hu
Cocreation Grass
Mississauga, ON

Jeffery Silcox-Childs
City of St. Catharines, ON

John Veit
Upper Grand District School Board
Guelph, ON

Event Calendar

Association Events are Highlighted in Green

June 6 to July 5
FIFA – Women's World Cup
fifa.com/womensworldcup

July
Irrigation Association
Smart Irrigation Month
irrigation.org/resources/

July 1
Canada Day

July 10 to 26
PanAm Games
toronto2015.org/venues for a look at the venues

August 7 to 15
ParapanAm Games
toronto2015.org

August 24
Ontario Turfgrass Research Foundation
Fundraising Golf Tournament
Thornhill Golf & Country Club, ON
otrf.ca

August 27
Prairie Turfgrass Research Centre
Turf Under Research Field Day
Olds, AB
oldscollege.ca/research-innovation/Turfgrass-Research/about-ptrc/faqs/

August 27
Sports Turf Canada
3rd Biennial Atlantic Field Day
Moncton Coliseum/CN Sportplexe
Moncton, NB
sportsturfcanada.com

September 23
Sports Turf Canada
Synthetic Sports Turf Field Safety & Maintenance Course
Stoney Creek Municipal Centre
Hamilton, ON
sportsturfcanada.com

September 24
Sports Turf Canada
28th Annual Ontario Field Day
Eastwood Park/Arena
Hamilton, ON
sportsturfcanada.com

January 15
Sports Turf Canada
Sports Turf Manager of the Year Award
Nomination Deadline
sportsturfcanada.com

Sports Turf Manager

FOR BETTER, SAFER SPORTS TURF. SUMMER 2015.

"Rest is not idleness, and to lie sometimes on the grass under trees on a summer's day, listening to the murmur of the water, or watching the clouds float across the sky, is by no means a waste of time."
~ John Lubbock

Inside this issue...

REGULAR COLUMNS, DEPARTMENTS & SMALL FEATURES

Deadline for Autumn 2015 Sports Turf Manager: September 4

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Figure 2

Figure 3

Figure 4

There are of course exceptions to every generalization and not unexpectedly, therefore, a handful of fungi have adapted to the more rigorous demands of the open spaces. From time to time often following prolonged periods of intermittent rain and somewhat cooler weather, mushrooms will pop up in abundance over lawns, fields and fairways.

Over the years, thatch builds up under the grass in fairways and other grassy places. The organic matter mixed into soil provides an ideal substrate for a host of microorganisms including fungi. Not only does it supply the food source (cellulose, etc.) for energy, but the thatch tends to hold the moisture for longer, which is ideal for fungus growth. As well as thatch, some turf fungi also grow on dead wood. This source becomes available when trees die, and the stumps and hidden roots buried in the turf can supply abundant food for a long time for these fungi.

What are mushrooms? The active fungus is a very fine thread measured in micrometres (1 micrometre = 1/1000 mm). It colonizes the thatch or buried wood. When times are right, the fungus produces spore producing bodies that we call mushrooms. Mushrooms are among Mother Nature's most prolific, sophisticated and successful reproductive machines. A good-sized mushroom can shoot off millions of spores. These are carried by breezes to other sites to attack more woody material or thatch. The following mushrooms are commonly found in open grassy areas.

Mica Cap (*Coprinus micaceus*, Figure 3, George Barron)
This is probably one of the most common and widespread of the lawn mushrooms. It grows in old hardwood stumps, dead roots and buried wood. It produces mushrooms early in the year, usually in large clusters in grass or soil above the buried wood. The caps are small, tan coloured, radially streaked and when young covered with a layer of tiny mica-like particles that glisten in the morning sun, hence the common name. These delicate flakes often disappear with rain or ageing. This species is edible but the mushrooms are flimsy and will disappear to almost nothing during cooking. Not only that, there are not any rave reports about its flavour!

Haymaker's Mushroom (*Panaeolina foenisecii*, Figure 4, George Barron)
Perhaps the most common of the lawn mushrooms, this species comes up early in the year scattered or in small groups. It is recognized by its small, hemispherical cap and mottled gills. The caps often change colour from darkish brown to light tan as they dry. The spores are black and will leave black smudges on the fingers if the gills are handled. This small mushroom is only one to three centimetres in diameter. It is reported as poisonous because it contains very small amounts of the hallucinogenic psilocybin chemical.

Agrocybe (*Agrocybe vervacti*, Figure 5, George Barron)
Common near the Great Lakes but not as well known elsewhere, this is a distinctive yellow-brown mushroom. The caps are up to 4 cm across. It produces mushrooms during wet periods in summer. Edibility is unknown and no one has volunteered to test it.

Fairy Ring Mushroom (*Marasmius oreades*, Figure 6, George Barron)
The word "choice" is often overused and overstated for wild edibles of all types. For the most part wild mushrooms aren't as flavourful as the gourmets tell us. The Fairy Ring Fungus, however, is an exception and is one of the better

tasting edible mushrooms. This knowledge won't do you a lot of good in Ontario, however, as the Fairy Ring fungus is not that common in this province. In the west, on the other hand, *Marasmius oreades* is abundant and is also a serious problem and very destructive of turf grasses. It produces mushrooms in rings (Figure 7) hence the common name. More important, in dry weather it shrivels up but with heavy dew or during rainy weather it resurrects itself and starts to produce spores. You can collect this fungus wet or dry and shrivelled up. If it is dry and it is put in water, it will flesh out and look just like "new". If it doesn't do this you've made a mistake and it isn't the Fairy Ring Mushroom!

Shaggy Mane (*Coprinus comatus*, Figure 8, George Barron)
Shaggy Mane is one of the "Inky Cap" group. In this group the caps break down rapidly by self digestion (autolysis) to an inky black fluid. Shaggy Mane is a medium sized mushroom that is easily recognized by its tall scaly cap. It is highly prized as an edible by some, but it ripens very rapidly to a black inky goo and must be eaten the day it is collected or you will have to suck it through a straw. Shaggy Mane is more common in late fall and more prolific on disturbed sites where it colonizes woody debris.

Tippler's Bane (*Coprinus atramentarius*, Figure 9, courtesy of Brian Shelton)
This mushroom is conical to bell-shaped and has a smooth, silky, streaked cap with a metallic grey sheen. This inky cap is edible but with a caution. Alcohol must not be consumed with the mushroom or for several days after. The caps contain a substance called coprine which acts like antabuse and, in association with alcohol, gives most unpleasant (but not lethal) symptoms such as flushing over the upper body, metallic taste on the mouth, nausea, etc. It produces mushrooms in summer and fall.

Dunce Cap (*Conocybe lactea*, Figure 10, George Barron)
This species is only a few centimetres across at best. It is recognized by the whitish to pale tan, conical cap and the gills that turn reddish brown as the spores mature. It is quite common and produces solitary mushrooms or in scattered groups in early summer.

Smooth Lepiota (*Leucoagaricus naucina*, Figure 11, courtesy of Brian Shelton)
One of the larger "grass" mushrooms, the Smooth Lepiota can be up to 10 cm across or more. The cap is hemispherical to convex with a central knob. The gills are white at first but become pale pinkish in age. The stalk is stout and swollen at the base and has a narrow ring. This edible species is never recommended because it is very similar to the deadly poisonous Destroying Angel which has already killed a number of Canadians over the years. It produces mushrooms in summer and fall and is especially common on newly developed grassy areas.

Spiny Puffball (*Lycoperdon curtisii*)
As with most puffballs, this mushroom when young is edible, but on closely mown grass, it is often sliced (Figure 12) before it has grown large enough to enjoy. When allowed to grow in taller grass, it becomes ornamented with spines (Figure 13), and still entirely white inside. As it matures, the inside turns entirely into spores, and these are released by rainsplash and blown by wind. This fungus can cause the darker stimulated green rings found on grass.


Figure 5


Figure 6


Figure 7

Figure 8

Figure 9

Fairy Rings often show up as one or more of three types: (1) dead ring, (2) stimulated ring, and (3) ring of mushrooms. In wetter regions across the country, we seldom see the dead ring (it is more likely to be Necrotic Ring Spot disease on Kentucky bluegrass if there are multiple dead rings close together). The stimulated ring is more common, and there's little that is done to control these except to mow off the faster growth in the stimulated ring more frequently, and perhaps to mask the non-ring parts with nitrogen or iron to make it all greener. The ring of mushrooms is also something that is just a nuisance and doesn't really harm the grass. But there are concerns by parents and pet owners that their children or animals will consume the magically appearing mushrooms, so it is probably better to mow them away quickly.

Next time you're wandering around a sports field or golf course, and it's a slow day keep your eye open for one or other of these common mushrooms (Figure 14, Figure 15, Figure 16). You don't have to eat them! You can enjoy them as one of nature's little wonders. If the worst comes to the worst you can always practice your putting or kicking game on a *Conocybe* or a *Panaeolina* and impress your friends with your knowledge of the names. Sadly for some, the hallucinogenic mushrooms of the *Psilocybe* genus (magic mushrooms) that are so common on the east and west coasts do not seem to thrive in the central regions. C'est la vie!

If you're really excited about all this, there is a locally written book on mushrooms available (Barron, 1999). Other useful guides to mushrooms of North America include Lincoff (1981), McKnight & McKnight (1987), and Miller (1978).

References

Barron, G.L. 1999. Mushrooms of Northeast North America. Lone Pine Publ., Edmonton, Canada. See www.uoguelph.ca/~gbarron.

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McKnight, K.H. and V.B. McKnight. 1987. A Field Guide to Mushrooms of North America. Peterson Field Guide Series, Houghton Mifflin, Boston.

Miller, O.K. 1978. Mushrooms of North America. Dutton, New York.

Figure 10

Figure 11

Figure 12

Figure 13

Figure 15

Figure 14

Figure 16

A World Without Grass

Justin Parsons, Director, Ontario Turfgrass Research Foundation

All of us, no matter what gender, age, or walk of life we come from, benefit from turfgrass. Our lives are improved in dozens of ways, just by its very existence. Yet few of us stop and think about what those benefits are or how different our world would be without it. Most people likely associate turfgrass with the environment and although the environmental benefits are numerous, turfgrass also contributes to our economy and our communities. The purpose of this article is to highlight the extent to which this precious resource contributes to the betterment of our lives and how vital foundations like the Ontario Turfgrass Research Foundation (OTRF) are because they ensure we take care of this resource that takes care of us.

Perhaps the best way to understand the extent to which turf contributes to our environment is to picture what a world without turfgrass would be like. Surprisingly, it's not that hard to do. All one needs to do is look back to China in the 1960's when a proclamation was put forth that stated all symbols of capitalism must be abolished – this included grassed lawns and trees. The result was a significant increase in air and noise pollution, soil erosion and temperature. Perhaps even more of a concern was the resulting dust storms that carried microscopic organisms which encouraged the spread of human disease. The Chinese government eventually realized the disastrous consequences of their actions and, to this day, continues to spend billions of dollars to repair the environmental damage that was brought about by their decision.

The environmental benefits of turfgrass do not end there however. In an age where greenhouse gas emissions and excess carbon dioxide in the atmosphere garners more attention than ever before, we cannot overlook the fact that turfgrass acts as a natural carbon sink, trapping this harmful gas, all the while increasing the production of oxygen. One could go on and on about how turfgrass improves air quality, reduces the need for air conditioning by providing a cooling effect, acts as a natural filter for our ground water and reduces flooding through soil stabilization. As with many things in life, we don't fully appreciate the value of something until it is removed or not properly cared for.

This is the very reason the OTRF exists, to ensure the continued advancement of turfgrass through research. In fact, the OTRF, which is a registered charitable foundation, has contributed nearly $1 million dollars toward turfgrass research over the last eight years, with many interesting projects in development. For example through the University of Guelph, Dr. Manish Raizada is researching a biological control for dandelions using probiotics. Just like with human consumption, probiotics stimulate metabolism by the addition of live microorganisms that reproduce. This probiotic for weed control uses live microorganisms from corn (naturally occurring beneficial microbes), which when applied to dandelions, acts to inhibit growth.

Over the years, the OTRF has funded many other unique projects that have helped to advance our knowledge of and our ability to promote turfgrass. The OTRF recognizes just how important this resource is to not only our environment, but also our economy and our communities at large. In Ontario, the turfgrass industry creates 33,000 jobs and contributes over $2.6 billion dollars in revenue to our economy annually. Not to mention the fact that turfgrass provides the very foundation for so many of our community activities and youth programs. From that standpoint, turfgrass contributes to a healthy lifestyle for all of us. Without local sports fields, parks and backyards, there would be no green spaces to work, live and play on.

When we take all of this into consideration we realize just how valuable a resource turfgrass really is as it contributes to the betterment of all of our lives in immeasurable ways. It is also easy to understand why associations like the OTRF exist and why it is so important to continue to support them in their efforts to fund turfgrass research. Through donations and support from industry partners the OTRF can continue to fund turfgrass research and ensure the advancement of one of our most precious resources – grass.

Atlantic and Ontario

Sports Turf Field Days Announced

The dates and venues for both the 3rd biennial Atlantic Field Day and the 28th annual Ontario Field Day have been confirmed: August 27 at the Moncton Coliseum and CN Sportplexe in Moncton NB, and September 24 at Eastwood Park and Arena in Hamilton Ontario.

So ***Make Moncton Your Mission*** and ensure ***Hamilton is on your Horizon***; mark your calendars for these educational and networking opportunities. The event committees are currently applying the finishing touches to the programs.

Visit **sportsturfcanada.com/events/event calendar** for all the details as they become available.

Sports Turf Canada Announces 2015 Sports Turf Manager of the Year - Robert Heggie

The Sports Turf Manager of the Year award is a prestigious honour which recognizes an individual's professional ability and contribution to the Canadian sports turf industry and shows appreciation for his or her proactive and progressive efforts within the profession.

Mr. Heggie is Head Groundskeeper at BMO Stadium and KIA Training Ground Academy, home to Major League Soccer's Toronto Football Club. But it is not his knowledge and expertise in managing fields for the sport's highest level of play that sees him recognized with this honour. "The resounding thread that runs through Robert's nomination and accompanying letters of support is his continuing effort to inspire and mentor those students who may aspire to become sports turf managers," explained association president Tennessee Propedo. "Robert is a frequent guest speaker for students at the University of Guelph, participates in the student-run Turfgrass Symposium, and is always willing to host tours of the Toronto FC stadium field and practice facility."

By sponsoring this award, the Guelph Turfgrass Institute assists in the recognition of sports turf managers who exemplify vision and leadership in the sports turf industry. "The GTI is honoured to partner with Sports Turf Canada in this award that helps to promote and recognize outstanding sports turf managers in Canada," added GTI director Rob Witherspoon. "Robert is a proud alumnus of the Turfgrass Management and Horticulture diploma programs at the University of Guelph who encourages students to consider sports turf as a career option and regularly invites both interns and graduates to work with the club's grounds crew." Said Gregory Patterson, one such graduate, "I wish that Robert and BMO Field were around when I was attending university; I feel I would have made the move from golf courses to sports turf much sooner."

The nomination deadline for the 2016 Sports Turf Manager of the Year is January 15.
Visit sportsturfcanada.com for eligibility, criteria and the nomination form.

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- A commitment to constantly improving our association to serve our members and our partners
- Environmental stewardship – we value sports turf and its impact on the environment
- A commitment to sports turf through ongoing educational opportunities, resources and the support of research
- Regular communication through ***Sports Turf Manager*** magazine, enews and website

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Strategies for Nitrogen and Potassium Fertilization of Sports Fields

Maxim J. Schlossberg (@turftwits or mjs38@psu.edu), Associate Professor, Turfgrass Nutrition & Soil Fertility,
Center for Turfgrass Science, The Pennsylvania State University

As a turfgrass and/or sports field manager, mention of these two important plant-essential nutrients probably grabbed your attention. Which it should, as the sum of nitrogen (N) and potassium (K) concentrations in healthy turfgrass vegetation exceed the combined sum of the remaining 12 plant-essential nutrients! While N and K play different roles in their support of turfgrass growth and health, inadequate supply of one or both limits the quality and resilience of managed turfgrass systems. This affords us a convenient segue to review perhaps the most critical criterion of the "essential" classification: irreplaceability….and yes, it's a word. Thus, we must remember that all the calcium, iron, sulfur, and/or phosphorus under the sun (and in no particular order) won't rectify N and/or K deficiencies in turfgrass!

To further emphasize their importance, nutrient storage/release mechanisms inherent to most mineral soils do not dependably supply N and K in the quantities required by vigorous and intensively-maintained turfgrass systems. Sand-based root zones, regardless of their degree of organic amendment and/or maturity, are even less-equipped. Thus, systematic application of N- and K-containing fertilizers each season is a certain requirement of turfgrass culture and management.

Turfgrass Response to Fertilization by N and K: A Brief Review

Under optimal environmental and cultural conditions, turfgrasses show a seemingly-unending growth response to increasing N supply. Dependable support of turfgrass vigour, density, and canopy colour make N fertilization an important cultural practice, especially when the associated pitfalls of inadequate or excessive N fertilization are considered (Figure 1). Leaves of cool season turfgrasses containing 3.8 to 4.4% N are considered N sufficient.

Turfgrass response to increasing K supply is unlike N, yet similar to the remaining plant-essential nutrients. While K fertilization fosters improved growth and quality of K-deficient turf, successive increases in K supply prove less visually-rewarding. Further K fertilizer additions that increase tissue K levels, but provide no concomitant improvement in quality or growth is termed luxury consumption. Potassium-sufficient cool season turfgrasses contain >2.2% leaf K, and demonstrate enhanced water use efficiency and stress tolerance relative to K-deficient plants (all other things equal).

Nitrogen (N) Fertilization Strategies

The long-standing approach to effective N fertilization is based on turfgrass species/cultivar, management intensity, system maturity, and climatic conditions. General nitrogen fertilization guidance in respect to these factors is provided for managers of Kentucky bluegrass and perennial ryegrass sports fields in temperate regions of Canada with a six month growing season (Table 1). The "moderate" management intensity column pertains to minimally-irrigated fields to which clippings are returned during mowing. Managers of highly-utilized and irrigated fields, from which clippings are removed, should follow the recommendations shown in the "high" management intensity columns; with further guidance based on systematic plant growth retardant/regulator (PGR) use.

I believe the most important aspect of N fertilization is consistent supply or availability. Turfgrass never thinks ahead and partakes in "binge N assimilation" at every opportunity. I liken this tendency to that of a dog whose owner pours three days of food onto the kitchen floor before going away for a

long weekend. It doesn't matter how many times the dog is told "everything in moderation," by Saturday afternoon all the dog food will have been devoured in two sittings; separated only by a 9-hour nap and perhaps a world-class bowel movement. To summarize, ensuring consistent availability of N to turfgrass remains an important responsibility of the manager.

There are two ways to do this. One is light and frequent N fertilization using quick release fertilizer sources; often referred to as "spoon-feeding." The alternative is by less frequent application of slow- or controlled-release N fertilizers at relatively higher rates. Ostensibly, there are costs and benefits associated with each approach. At the risk of being redundant, I must again emphasize the importance of employing quick-release and/or controlled-release fertilizers as needed to avoid "peaks" and "troughs" of N availability to intensively-managed turves. Yet I would be remiss to ignore the occasions when a "peak" in N supply proves useful in sports field management, such as one coinciding with cultivation procedures (verticutting or coring) or following a period of intense use and traffic.

Studies conducted on creeping bentgrass at Penn State University and perennial ryegrass at North Carolina State University (Bowman, 2003) show beneficial whole-plant response to more-frequent delivery of soluble N fertilizers at a given annual N rate. Likewise, recent Kentucky bluegrass field research conducted at Penn State University (Schlossberg et al., 2014) reveals significant value in controlled-release and enhanced-efficiency N fertilizer technologies. Figure 2 illustrates varying N release patterns 4-months following 0.9 lbs N / 1000 ft^2 (0.4 kg N / 100 m^2) applications of granular urea, UMAXX (stabilized urea), and Duration 45 (coated urea).

Consideration of soil physical and chemical properties is an important aspect of N fertilizer selection, particularly in regard to soluble N fertilizers, i.e., quick-release sources. Nitrate salts, such as calcium and potassium nitrate, are prone to leaching; and tend to slowly raise the pH of soils they are systematically applied to. Thus, nitrate salts should be avoided on soils that are sandy and/or possess supraoptimal pH levels relative to the resident turfgrass.

Ammonium salts, such as ammonium sulfate, ammonium chloride, and ammonium thiosulfate are promptly assimilated by turfgrass and instigate rapid growth. Likewise, they tend to lower the pH of soils they are systematically applied to. Thus ammonium salts are poorly-suited for applications >0.7 lbs N / 1000 ft^2 (>0.3 kg N / 100 m^2) as well as to fields possessing suboptimal soil pH levels. Soil chemical properties should also be considered when selecting coated urea fertilizers. Urea-N is prone to volatilization loss on alkaline soils, thus sulfur-coated urea (SCU) is a better controlled-release choice than polymer-coated urea for sports fields possessing soil pH levels >6.9.

Potassium (K) Fertilization Strategies

My philosophy on K fertilizer recommendations takes the following factors into consideration: turfgrass species/cultivar, soil test levels (lab results), irrigation use/quality, and N fertilization. One may be surprised to find this list excludes soil cation exchange capacity (CEC), mineralogy, and texture. It is my opinion that those factors are already integrated into soil test levels, and need not be double-handled. The Ontario Ministry of Agriculture Food and Rural Affairs (OMAFRA) agrees, as they neither adjust K recommendations on the basis of soil CEC nor report soil K levels as a percentage thereof (Reid, 2006).

As with N, frequent K_2O fertilization prevents the likelihood of K deficiency. Turfgrass acquires K from soil solution; and while exchange site K is in equilibration with soil solution and recharges soil solution K as turfgrass roots deplete it, soluble K fertilizer application recharges soil solution more dependably. Recent results of field research, particularly a 102-plot Kentucky bluegrass study conducted on a fine-textured soil here at Penn State University, prompted my reconsideration of basing K fertilizer recommendations on soil K levels alone.

Specifically, routine Mehlich-3 analysis of samples collected from the 0-10 cm soil depth in early May showed 300 mg/kg soil K levels. On this basis, no applications of K fertilizer were made or planned for the remainder of the season. Analysis of Kentucky bluegrass clippings collected in July indicated K sufficiency (2.5 to 3.4% leaf K). Yet K concentration of clippings collected in early September

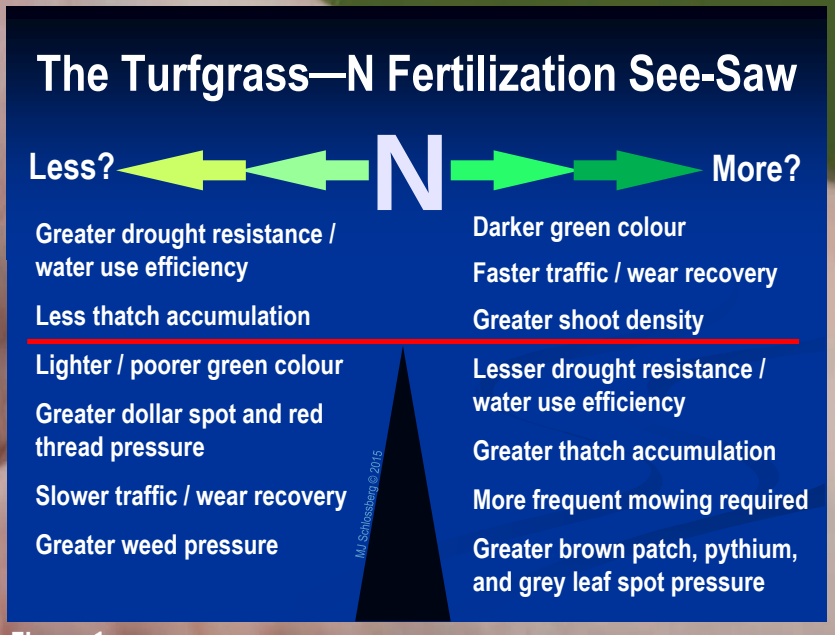

Figure 1

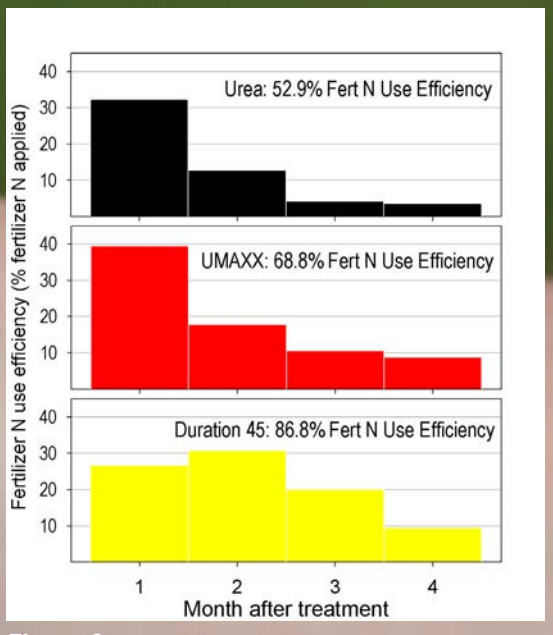

Figure 2

ranged from 1.6 to 2.5%. Despite confirmed sufficiency of all other macro- and micro-nutrients in these clippings, subsequent analysis of multispectral radiometer measurements collected weekly in August and September revealed declining density and colour of Kentucky bluegrass plots having <2.2% leaf K in early September.

General potassium fertilizer guidance in respect to the above considerations is provided for managers of Kentucky bluegrass and perennial ryegrass sports fields in temperate regions of Canada with a six month growing season (Table 2). As first proposed by Carrow et al. (2001), seasonal K_2O fertilizer suggestions are expressed as a percent mass (%) of the planned annual N fertilization rate (lbs / 1000 ft^2 or kg / ha).

As an example, the suggested annual K2O fertilization rate for non-irrigated Kentucky bluegrass fields maintained under moderate intensity, showing recent soil test levels of 60 mg K / kg soil, and typically receiving 3 lbs N / 1000 ft^2 (1.5 kg N / 100 m^2) annually, would be 1.5 lbs K_2O / 1000 ft^2 (0.8 kg K_2O / 100 m^2). Suggested seasonal delivery would be 0.3 lbs K_2O / 1000 ft^2 (0.15 kg / K_2O 100 m^2) in both May and September, plus a total of 0.9 lbs K_2O / 1000 ft^2 (0.4 kg K_2O / 100 m^2) during July and August as two or more split applications. Of course, circumstance does justify deviation from the schedule shown. Application of K_2O fertilizer is recommended following

Table 1. Suggested seasonal distribution of N supply (lbs N / 1000 ft^2) for Sports Fields in temperate regions of Canada (six month growing season); by turfgrass species, system maturity, and management intensity.

	Hybrid Kentucky Bluegrass Sports Fields						Perennial Ryegrass Sports Fields					
	1st or 2nd Season from Establishment			3rd+ Season from Establishment			1st or 2nd Season from Establishment			3rd+ Season from Establishment		
	Management Intensity			Management Intensity			Management Intensity			Management Intensity		
	Moderate*	High†		Moderate*	High†		Moderate*	High†		Moderate*	High†	
	no PGR	no PGR	PGR	no PGR	no PGR	PGR	no PGR	no PGR	PGR	no PGR	no PGR	PGR
	suggested N supply (lbs N / 1000 ft^2)						suggested N supply (lbs N / 1000 ft^2)					
Months 1 thru 2	0.75	0.9	0.8	0.6	0.8	0.7	0.8	1.0	0.9	0.75	0.9	0.8
Month 3	0.5—0.8	0.6—0.9	0.5—0.8	0.4—0.6	0.5—0.8	0.5—0.7	0.5—0.9	0.6—1.0	0.5—1.0	0.3—0.5	0.4—0.6	0.3—0.6
Month 4	<0.6	<0.6	<0.6	<0.3	<0.4	<0.3	<0.5	<0.5	<0.5	<0.25	<0.4	<0.3
Month 5	0.6—0.85	0.7—1.0	0.6—0.9	0.4—0.6	0.6—0.7	0.5—0.6	0.7—1.4	1.0—1.4	0.8—1.4	0.6—1.0	0.9—1.2	0.75—1.0
Month 6	0.8—1.5	1.0—1.5	1.0—1.5	0.8—1.1	0.8—1.3	0.8—1.2	0.5—0.7	0.6—0.8	0.5—0.7	0.3—0.5	0.4—0.6	0.3—0.6
Total	**2.75—4.5‡**	**3.3—4.9‡**	**3.0—4.6‡**	**2.3—3.2**	**2.8—4.0**	**2.6—3.5**	**2.6—4.3‡**	**3.3—4.7‡**	**2.8—4.5‡**	**2.0—3.0**	**2.7—3.7**	**2.25—3.3**

*, Moderate Management Intensity: minimally-irrigated fields to which clippings are returned during mowing.

†, High Management Intensity: highly-utilized and irrigated fields, from which clippings are removed.

‡, High ends of suggested N supply ranges for recently-established Sport Fields apply to constructed sand-based root zones.

Table 2. Suggested seasonal distribution of K_2O fertilizer as % annual N rate to Sports Fields in temperate regions of Canada (six month growing season); by turfgrass species, irrigation availability, and soil K levels.

	Hybrid Kentucky Bluegrass Sports Fields						Perennial Ryegrass Sports Fields					
	Irrigation						Irrigation					
	None		High Quality		*Hard or Effluent		None		High Quality		*Hard or Effluent	
	Soil Test K†, mg/kg		Soil Test K†, mg/kg		Soil Test K†, mg/kg		Soil Test K†, mg/kg		Soil Test K†, mg/kg		Soil Test K†, mg/kg	
	< 75	> 75	< 90	> 90	< 100	> 100	< 75	> 75	< 90	> 90	< 100	> 100
	Suggested K_2O fertilization as a % of the annual N fertilization rate (w/w)						Suggested K_2O fertilization as a % of the annual N fertilization rate (w/w)					
Months 1 thru 2	10%	10%	10%	10%	25%	15%	10%	10%	10%	10%	20%	10%
Months 3 thru 4	30%	15%	40%	30%	50%	40%	30%	15%	35%	30%	45%	45%
Months 5 thru 6	10%	10%	20%	10%	25%	20%	15%	15%	30%	20%	35%	25%
Total	**50%**	**35%**	**70%**	**50%**	**100%**	**75%**	**55%**	**40%**	**75%**	**60%**	**100%**	**80%**

*, Irrigation water having pH >7.4 and a bicarbonate (HCO_3^-) level >150 mg/L; or a concentration of total dissolved solids (TDS) >800 mg/L.

†, Soil test potassium (K) in the upper 0-10 or 0-15 cm as determined by ammonium acetate or Mehlich-3 extraction.

a substantial lime or gypsum application >10 lbs / 1000 ft^2 (>5 kg / 100 m^2), and/or significant irrigation (for the purpose of purging/leaching accumulated salt) or rainfall event(s).

References

Bowman, D.C. 2003. Daily vs. periodic nitrogen (N) addition affects growth and tissue N in perennial ryegrass turf. Crop Science 43:631–638.

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Reid, K. (ed.) 2006. Soil Fertility Handbook (Publ. no. 611). Ontario Ministry of Agriculture Food and Rural Affairs (OMAFRA). Queen's Printer for Ontario. Toronto, Canada.

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IN THE NEWS

TDI Announces New Division – Ecoblue Systems

TDI International wishes to introduce our newest division, Eco Blue Systems, a specialty sports turf renovation contractor. Drawing of 28 years of turf renovation, precision drainage installation on over 1000 properties, Eco Blue offers our expertise in sports field drainage and restoration.

Sports Turf technical advisors:
Mark Hughes - 226-808-0386
or email mhughes@ecobluesystems.com

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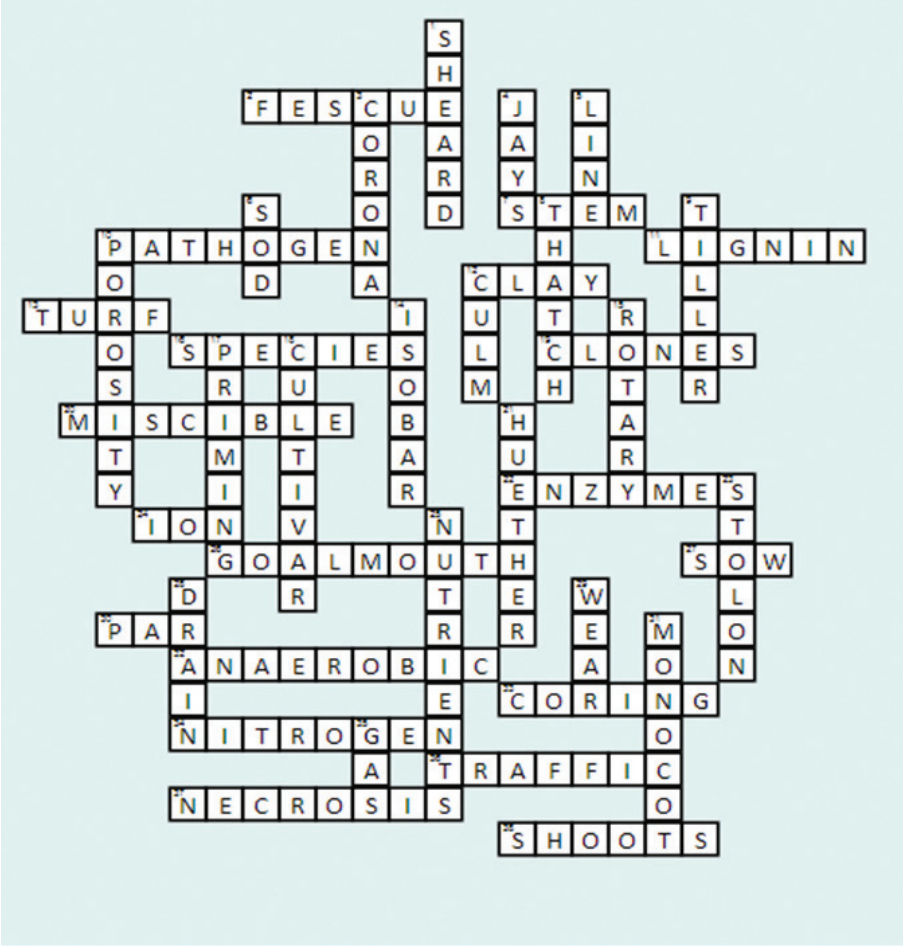
Sports Turf Mindbender

Puzzle in the Spring 2015 issue
How did you do?



Author: Mike Bladon

ACROSS

2 Lower wear tolerant turf
7 Plant portion
10 Virus
11 Organic component of turf
12 Soil component
13 The "T" in STC
16 Unit of botanical classification
19 Genetically identical plants
20 Capable of being mixed
22 Organic catalysts
24 Charged atom
26 Where the keeper typically is
27 To plant
30 Average
32 Oxygen deficient
33 Cultivation
34 Atmospheric gas and granular fertilizer
36 Pattern of travel
37 Plant death
38 Roots and ....

DOWN

1 He wrote the STC Bible on turf
3 Beer or ring around the moon
4 New turf for MLB's Toronto team
5 Field marking
6 Transplant
8 Undecomposed plant matter
9 Sprout or stalk
10 Influences percolation
12 Hollow stem
14 Barometric line
15 Mower type
17 Water to seed
18 Species selection
21 STC Executive Manager
23 Horizontal stem
25 Essential to plants
28 Draw off liquid
29 Traffic that affects turfgrass
31 One cotelydon
35 Vapour

Football/Soccer Field Safety and Maintenance Checklist

Prior to practice or a game, assess the following field characteristics and make the necessary correction to the statements marked, 'No/Needs Attention' before allowing players on the field.

Playing Surface – All Types

Yes	No/Needs Attn	
☐	☐	Maintenance equipment such as rakes, hoes, etc. have been removed from the field.
☐	☐	Litter and unsafe debris have been removed from the field and player/ spectator areas.
☐	☐	Irrigation heads are installed as per manufacturer's recommendations with no protrusions on the playing surface.
☐	☐	If there is an automatic system, the runtimes for the stations should be scheduled as per game times.
☐	☐	The field was constructed according to recommended industry specifications.

Playing Surface – Synthetic Turf

Yes	No/Needs Attn	
☐	☐	There are no worn areas on the synthetic material.
☐	☐	There are no rips or tears on the synthetic material.
☐	☐	Seams are secure.
☐	☐	The synthetic material is not buckling or bulging.
☐	☐	Synthetic fibers are standing upright.
☐	☐	There is adequate infill material that is evenly spread.
☐	☐	Water is readily available for washing away undesirable fluids.
☐	☐	The footwear that is being worn by players is acceptable.

Playing Surface – Natural Grass

Yes	No/Needs Attn	
☐	☐	There is at least 75 percent coverage of turfgrass on the field.
☐	☐	There are no bare spots with a hard soil surface exposed.
☐	☐	Soil is well drained with no standing water.
☐	☐	Turfgrass is uniform in colour, height, and density.
☐	☐	Turfgrass has strong root system, limiting "blow-outs"
☐	☐	There are no weeds with thorns, bristles or burrs.
☐	☐	There are no holes or mounds made by moles, gophers, or other animals.
☐	☐	There are no ruts or trenches caused by equipment use or field wear.
☐	☐	There has been communication between the maintenance staff and coach/ facility user.

Goals and Goal Posts

☐	☐	Goal posts are straight and securely anchored.
☐	☐	Goal posts are adequately padded.
☐	☐	Concrete for goal posts is below the surface.
☐	☐	There are not sharp edges, protrusions or fractures on the goal.
☐	☐	Goals are anchored securely.
☐	☐	All bolts, screws and connections for the goal are intact and securely tightened.

Field Markings

Yes	No/Needs Attn	
☐	☐	If multi-use field, lines are distinguishable between sports.
☐	☐	Lines are bright.
☐	☐	Lines are correctly marked per the appropriate governing body.

Out-of-Bounds/Transition Areas

Yes	No/Needs Attn	
☐	☐	There is a minimum of 25ft. (7.6m) around the field for players to run safely out-of-bounds.
☐	☐	There is a minimum of 50ft. (15.2m) between fields (if multi-field complex).
☐	☐	All catch basins are adequately covered.
☐	☐	The transition area to the track is easily identifiable and level.

Fencing *(skip if your field does not have fencing)*

Yes	No/Needs Attn	
☐	☐	Fences are securely set in the ground.
☐	☐	Fence posts are outside of the playing area.
☐	☐	There are no concrete footings exposed above ground.
☐	☐	Fencing is securely attached to its posts.
☐	☐	There are no large gaps in the fencing or between the ground and the fence.
☐	☐	Top and bottom tension wires are in place to secure the fence.
☐	☐	The wire ends of the fence are not exposed at the top or corners.
☐	☐	There are no damaged areas that protrude, are sharp or loose.

Bleachers/Facility *(skip if your field does not have bleachers/facility)*

Yes	No/Needs Attn	
☐	☐	Nuts and bolts are tight and in sufficient number.
☐	☐	Guard rails are securely in place.
☐	☐	The plank or railing end caps are securely in place.
☐	☐	There are no splinters or worn areas (wooden bleachers).
☐	☐	There are no harzardous protrusions or sharp edges.
☐	☐	The supply and location of waste cans is adequate.
☐	☐	There is appropriate signage notifying players and spectators of rules, appropriate behaviour and deficient conditions.
☐	☐	There are public telephones or a staffed office for emergency situations.
☐	☐	Areas under repair are identified and posted appropriately.

Lighting *(skip if your field does not have lighting)*

Yes	No/Needs Attn	
☐	☐	Lighting has been installed/inspected by a trained engineer or technician.
☐	☐	All lights are working.
☐	☐	The light's beam adequately and uniformly covers the field.
☐	☐	The lighting foot candes meet industry recommended specifications.

General

Yes	No/Needs Attn	
☐	☐	There is a flag or other signaling system to alert players to leave the field if inclement weather or other danger is imminent.

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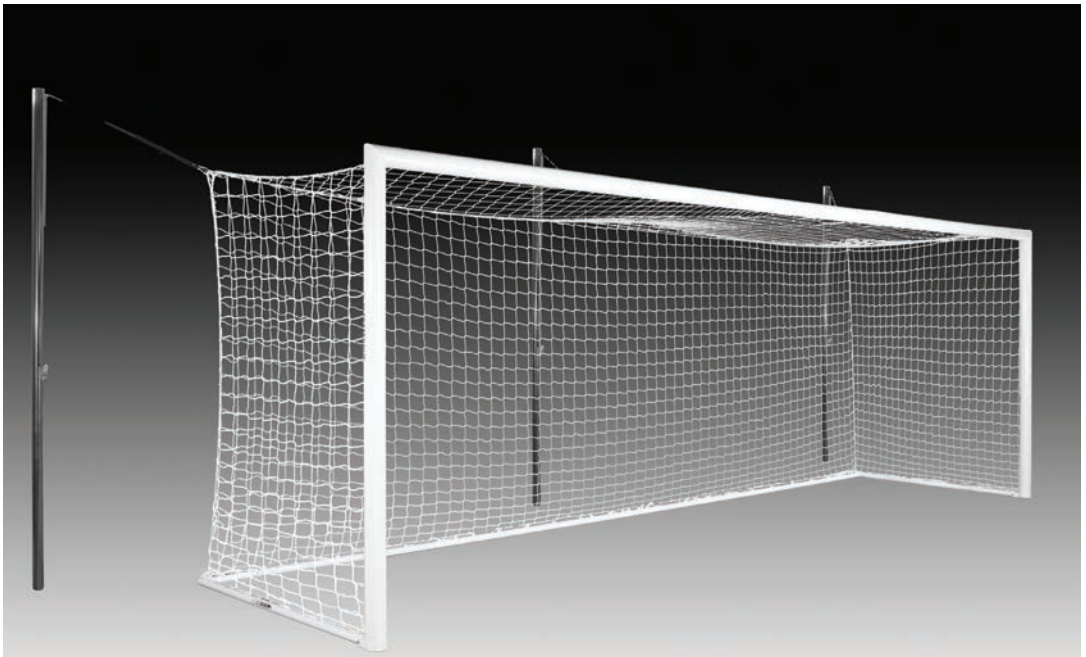

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