>> **A BROADCAST APPLICATION** of granules containing *Phoma macrostoma* on research demonstration plots in Saskatoon.

Phoma macrostoma: update on the new turfgrass bioherbicide

FOR SEVERAL YEARS, the fungus *Phoma macrostoma* has undergone extensive evaluation by Agriculture & Agri-Food Canada and The Scotts Company to see if a bioherbicide could be developed to control broadleaved weeds in turfgrass. In 2009, the summer issue of *Sports Turf Manager* reported on its discovery as a potential bioherbicide, and some of the research demonstrating its efficacy and crop safety.

Last June (2011), the Pest Management Regulatory Agency approved a conditional registration for *Phoma macrostoma* to be used domestically and commercially for control and/or suppression of weeds such as dandelion, scentless chamomile, English daisy, white clover, black medic, Canada thistle, chickweed, broadleaf plantain, and ragweed. The bioherbicide may be used safely on a variety of turf types such as Kentucky bluegrass, bent grass, perennial or annual ryegrasses, fescues, bromegrasses, timothy, and Bermuda grass.

The fungus is formulated into granules which may be applied to either newly-seeded or well-established lawns from a ready-to-use applicator for spot treatments or by broadcasting the granules as either pre-emergent or post-emergent applications. The product may be applied anytime from spring through fall, but it works best when the mean day time air temperature is hovering above 20°C (15-30°C range) and the soil is relatively moist. The product does not need to be "watered-in" but some precipitation or irrigation (up to 1-3 inches) within 24-72 hours after application would be beneficial particularly if the soil is not friable or moist.

Continuing research has expanded our knowledge of how the bioherbicide will perform in the field. Studies have shown that extreme moisture events around application will reduce the level of weed control attained, especially on sandy soils. The bioherbicide may be applied at the same time as commercial granular fertilizers which may result in a 10-15% enhancement in weed control.

Currently, *Phoma macrostoma* is undergoing scale-up development to be able to efficiently produce commercial quantities, thus a commercial launch is still a few years away. ■

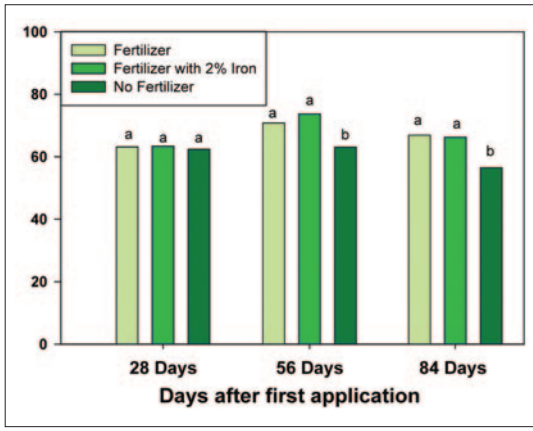

Figure 2.
GRANULES of *Phoma macrostoma* were applied at the 1X rate with or without commercial fertilizer granules at Marysville, Ohio. The use of fertilizers with the bioherbicide improved weed control later in the season. (Different lower case letter show significant difference among treatments using an LSD test at P= 0.05.)

K.L. Bailey is with Agriculture & Agri-Food Canada, Saskatoon, SK. S. Falk is with The Scotts Company, Marysville, OH.

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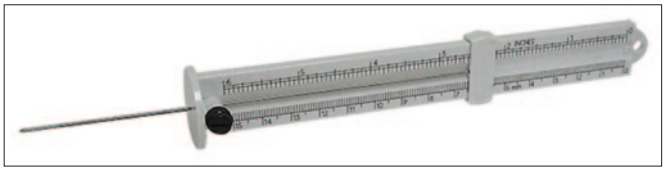
Editor's Note: The referenced article in the Summer 2009 issue of *Sports Turf Manager* may be accessed online at www.sportsturfmanager.com/Publications/SportsTurfManager/Archive.

Maintaining synthetic surface safety

WITH THE INCREASING FOCUS on concussions in sports, many aspects associated with athlete safety are under higher levels of scrutiny. The hardness of the playing surface is one of them. While both natural and synthetic turf fields can reach unsafe hardness levels, synthetic turf fields seem to receive the most attention. Assuming a proper installation, synthetic fields start off well below hardness thresholds in the months after install. Over time, these fields may get harder and in some cases, if not properly cared for, can reach unsafe levels. So, why do synthetic turf fields get hard? Is it compaction? Or is there something else going on?

It is a common belief that compaction of the infill is the reason fields get hard. For many of us, that seems to makes sense. We know that heavy use on a natural turf fields leads to soil compaction and, in turn, increased surface hardness. But, to what degree does crumb rubber and sand compact? Certainly there is a "settling-in" period in the weeks after installation, but based on our observations, compaction is minimal after the settling-in period in most cases. In fact, most infill is sized such that only limited compaction is even possible due to the relatively uniform size of the infill particles.



>> **Top: A FIREPROOFING DEPTH GAUGE** is a good tool to measure infill depth and can be purchased for less than $15.

>> **Bottom: THE SMALL AMOUNTS OF INFILL** collected in shoes, clothing, equipment bags, etc., may seem insignificant individually, but those small amounts add up.

RESEARCH RESULTS

Our research plots at Penn State provide an interesting example. In 2002, various synthetic turf companies installed their products which were then used in a research trial that concluded in 2010. Over the course of 8 years, a section of each of these plots was exposed to 96 simulated games per year using our traffic simulator. By the end of the trial, those trafficked sections were exposed to more than 1,500 passes with our traffic simulator. However, by the end of the study, surface hardness values were still well below the published threshold of 200 G's set by the American Society for Testing and Materials (ASTM) and the US Consumer Products Safety Commission. Even wheel ruts caused by the tractor repeatedly pulling the traffic simulator over the same area for 8 years tested to be well below the 200 G level. This example helps illustrate that compaction alone is most likely not the main cause of excessive surface hardness.

We have also observed specialized machines remove infill from an existing field, "clean" it, and reinstall it back into the carpet in an effort to reduce surface hardness. The Gmax values before and after this process were essentially the same. It was only after new rubber was added that the Gmax was reduced.

Other factors, however, can compromise the infill resiliency and thus increase surface hardness. For example, excessive and repeated painting of lines and logos without the occasional cleaning of the painted areas, including removal or wash-through of old paint, can lead to a hard surface. Excessive deposits of debris and particulate matter may compromise the infill if the surface is not cleaned over time. The build-up of this type of debris takes many years in most cases and typically is not a major concern for fields with even moderate maintenance.

So why do some fields become hard over time? We believe that "walk-off" crumb rubber and the associated loss of infill depth is the main cause for increases in surface hardness of synthetic turf fields. "Walk-off" crumb rubber refers crumb rubber that leaves the field in the shoes, clothing, equipment bags, etc. of field users. While it seems like an insignificant amount on an individual basis, when looked at collectively for all field users, it begins to add up. Add in the infill material that is removed from necessary regular maintenance activities such as grooming, brushing, sweeping, and blowing, and the amount of infill removed from the field can be substantial.

OBSERVING "WALK-OFF" CRUMB RUBBER

This idea of "walk-off" crumb rubber is supported by our observations as we have tested many fields in the United States. Almost every time our tests show a high surface hardness value, it is associated with a low level of infill. The infill creates the padding and shock-absorption for the synthetic turf system. As the thickness of that "padding" is reduced, there is less of a cushion between the surface and the hard base under the turf, thus resulting in elevated surface hardness. This is often most evident in the high-use areas of the fields, where the majority of play occurs and, in turn, the majority of the rubber "walks off." Thinking back to our research plots here at Penn State, infill depth remained at or very close to installation levels

even after 8 years of intense simulated field use. The only difference between our plots and real fields is a lack of field users and therefore a lack of "walk-off" rubber. The traffic simulator did not carry a significant amount of infill off the plot areas.

To combat this problem, it is important to monitor infill levels—especially in high-use areas of the field. Knowing the target infill depth from your turf's manufacturer is the first step. Once infill levels begin to drop by more than several millimeters, it is time to topdress additional rubber onto those areas. This means that extra crumb rubber should be on site at all times.

Infill depth can measured by using specialized depth gauges (gauges used for measuring fire proofing materials work well and typically cost less than $15) or something as simple as the end of a landscape flag. When measuring infill depth, it is important to make sure you reach the back of the turf; this may require a few "stabs" until you feel the backing. If using a landscape flag, after you feel the backing of the turf with the tip of the flag, place your finger tip onto the surface of the infill, pull the flag out, and measure the distance between your finger tip and the end of the flag.

Once you determine that additional rubber is needed, you can either use a topdresser for large areas or apply infill by hand for small areas; experiment by using very small amounts at first. Be sure to work the rubber into the carpet fibers with a groomer or broom and then apply another small amount and repeat. Pay special attention to areas of intense use such as lacrosse and soccer goal mouths and sliding areas on baseball fields. It does not take long for infill levels to drop in these areas. An added benefit to maintaining proper infill levels in these locations is increased fiber life. As infill levels drop, more of the fiber is exposed to UV light and wear and tear, increasing the speed of fiber degradation.

MATCH YOUR MATERIAL

It is extremely important to use the same infill that the manufacturer used when constructing the field. This way the infill sizing and type will match your existing infill. If you mix infill types, you will be lowering the compaction resistance of the infill and won't be getting the maximum benefit from your infill padding.

Once the infill is at the optimum depth, it is important to remember that regular maintenance practices should continue to be performed in order to maintain the best possible surface conditions. Be sure to check with your turf's manufacturer for the recommended practices for your field. And, if it is not part of your routine maintenance now, we recommend that you add the monitoring of infill depth and subsequent addition of infill when needed.

The issue of surface hardness on athletic fields is an important one. Proper maintenance practices, including monitoring infill levels and adding infill when necessary, are the key to providing a playing surface that maximizes both playability and safety. ■

Tom Serensits is manager of the Center for Sports Surface Research at Penn State. Dr. Andy McNitt is the Center's director, as well as program coordinator for Penn State's turfgrass science major, and a professor of soil science.

European adventure:
one intrepid turf manager's report on bold practices

JERAD MINNICK, sports turf manager for the Maryland Soccer Foundation, Boyds, MD, spend a few days last spring visiting some of his peers in Europe to see how they keep their pitches and other playing surfaces in good playing condition. He blogged daily on http://growinggreengrass.net and here we share his impressions:

>> L TO R: Richard Campey, managing director, Campey Turf Care Systems, Minnick, Steve Braddock, head groundsman, Arsenal Training Ground, and Simon Gumbrill at Arsenal Training Ground.

May 6

The main observation of Day 1 in London in GREEN! For weather that is in the 40's and 50's (F), the fact is all the grass (and flowering plants) are actively growing. Obviously I knew a trip to the UK would be filled with ryegrass, but observing it dramatically highlights rye's ability to grow in cooler conditions than Kentucky bluegrass. The ryegrass, even in the common areas that is not even regularly maintained, is growing and green. Nearly every day of our "cool weather" during the month of April was warmer than even 1 day of the weather here in London. And just this past week did we begin to see sustained growth similar to what I am observing here.

So the debate renews in my mind on the pros and cons of using ryegrass in our Washington, DC climate. Following a gray leaf spot outbreak last August, I swore I would never use it again. But now after the cool, inconsistent spring here I am back to re-thinking that. One of the core times that we need to increase our play is in the cooler weather of Feb, March, Nov, and Dec and ryegrass is certainly an avenue to help.

The questions created now revolve around rootzone in management of ryegrass. On a sand-based rootzone, the "moist" conditions that cause disease on ryegrass on our native soil fields are greatly reduced. And managing nitrogen and the use of basic chlorothalonil helps combat gray leaf spot. So, on a field that gets the most traffic from Feb- June and Sept-Dec. isn't overseeding ryegrass into the bluegrass stand a good idea?

Another question: is the disease pressure different on sand v. native soil? Is the amount of soil borne pathogens in a native soil higher than a sand, especially a new sand on a new field? It seems the population would be different. On the "control" field we have each year where no fungicides are used, the soil biological activity is staggering. How different are the pressures?

May 8

Wow what a fantastic day with one of the UK's finest gentleman, Mr. Simon Gumbrill. Starting at Wimbledon, progressing through horrendous London traffic to Emirates Stadium, off to the Arsenal Training Ground, and finishing with a pass through the Chunnel to Calais, France and Gent, Belgium for the night. Tomorrow we are off to the Netherlands near Eindhoven and the Koro by Imants factory for a demonstration day, then up to Amsterdam and Europort for the boat back to the eastern UK. Thank you to Simon, [and] to Mr. Richard Campey who I got the pleasure to see at Arsenal today, and thank you as well to Ms. Julia Campey. I could not have enjoyed the day more!

Many thanks to head groundsman Mr. Eddie Seaward for having me to Wimbledon today, as well as to Grant Cantin for taking time from his busy day to show us around. Preparing for the Championships and the Olympics, I can't imagine the stress they are under.

Thanks to Mr. Paul Ashcroft for sticking around to say hello, even with our being delayed in traffic and his having prior commitments. What a class operation. No wonder he collected the award for Groundsman of the Year in the Premier League. Even with corporate events taking place, the pitch is tight and gorgeous green.

And thanks to Mr. Steve Braddock, Head Groundsman at the Arsenal Training Ground. In the middle of renovations, Steve was very generous with his time to show us around and discuss the different ideas and successes they have through the challenges of such a large scale training ground. Steve's reputation of perfection is well deserved!

The most amazing part of the day was the sheer kindness and hospitality that these

grounds crews showed me, an American [an outsider]. I could understand skepticism but there was absolutely none. What generous and genius individuals that make up these groups. I hope we in America are the same for all our colleagues, large and small, home and abroad. None of us can succeed without learning and respect. And respect and professionalism is what I saw exhibited the most today.

Off to bed in Belgium.

May 9

Wednesday was another tremendous day as we traveled from Belgium to Reusel, in the southern region of the Netherlands near Germany, for a demonstration day with Imants, which manufacturers unique and high quality turf care equipment, along with specialty agricultural equipment, and was founded in Reusel over 125 years ago.

Hats off to Hans de Kort of Imants for assembling a wonderful demo day that was attended by nearly 50 groundsmen from the surrounding areas in the Netherlands. Thank you to Simon Gumbrill of Campey Turf Care and Hans for allowing me to attend.

The demo/field day was unique by US standards, as the attendees got the see the machines in action doing an actual renovation on a youth soccer pitch in the park behind the factory. The demonstration illustrated the European "renovation" process which involves stripping a slight layer off the top of the pitch and re-growing the pitch from seed and rejuvenation from the crown of the existing grass plants. (MUCH more on this eye opening process to come.) Machines demonstrated included the Koro by Imants Field Topmaker to strip the top layer off, the Koro by Imants Field Sweeper to clean up any spilled debris, the Imants Shockwave deep aerated the soil, the Speed Dresser topdressed sand, and the Koro by Imants Recycling Dresser mixed in the sand and refreshed the soil air space. I have so many thoughts and ideas from this; it is going to take me some time to wrap my head around the possibilities.

>> **JERAD,** left, with Ko Rodenburg, founder of KORO Systems (and a former parks superintendent for the City of Rotterdam).

An additional highlight of the day outside of the machines was meeting Mr. Ko Rodenberg, the former Parks Superintendent for the City of Rotterdam and inventor of the Koro line of turf care equipment. I enjoyed the time talking with Mr. Rodenberg in which I

learned so much, and I am indebted to him for being so generous with his time.

The days end came entirely too fast as we had to head up to Rotterdam to Europort for the boat back to the UK across the North Sea. Sleeping on a cargo ship was an experience all in itself! But we arrived safely back to the UK through Hull Port at 8am this morning, set for another full and fun day.

May 10

Thursday marked a visit to see Mr. Alan Ferguson, the Head Groundsman of the English FA, tasked with getting St. George's Park prepared for its opening this summer. The FA is in good hands, that is for sure. Not only are the pitches absolutely gorgeous, but Mr. Ferguson and his wonderful wife, Mrs. Carol Ferguson, have a vision for the park is grand and fantastic. I can not thank either of them enough for taking time to see us today to show us around and share some stories over tea. The conversation, the ideas, the attitude, the dedication; I hope to be able see the park again next year to see the dramatic change it will go through. The expanse of the park and the rolling hills reminded me a lot of home at SoccerPlex and so did all the rain!

Have a look at the park: http://www.thefa.com/St-Georges-Park

Thank you again to the Fergusons for having us and to Simon for leading the "escaped" through London, France, Belgium, Netherlands, and now back to Manchester in the northern UK.

We visit the champions tomorrow. [Who will it be] Man U or Man City!?

THATCH MANAGEMENT

THE PAST 10 DAYS have seen an up and down weather pattern in the Mid-Atlantic. A few cool, crisp days followed with hot, dry then hot, humid days. Dry conditions have prevailed until today, allowing some aggressive cultivation to take place in conjunction with the wrap up of soccer league season and in preparation for summer club lacrosse season.

On cool season pitches, aeration pass number 6 took place with deep tine aeration at 8" w/ an aggressive 15 degree kick, followed with pass number 7 w/ 3/4" coring tines on 2x2 spacing. With the combination, deep compaction relief took place along with air venting and thatch reduction in the top organic layer, both much needed following the heavy traffic of May and entering the summer stress period. All aeration techniques will continue, just not as aggressively though into the heat.

Bermudagrass received an aggressive core aeration as well. With it picking up growth and starting into camp season next week, this is the last break during the week bermudagrass will see until the last week of August. Deep tine aeration will follow suit next week in the evenings following camps.

In reference to thatch reduction from core aeration, following the 1st sweeping of cores from the field we brushed the fields with a heavy brush to stand the grass plants back upright and fluff up any remaining cores. Around Europe, brushing was common so I wanted to add it to our program immediately. I assumed that the main benefit would be standing up the grass for better health and mowing. Well I was right on that part, but the biggest immediate difference was the remaining thatch on the very top of the field that was fluffed up. It was staggering! Piles of thatch were everywhere. Certainly we expect to bring up some, but had no idea that it would be the amount it was. Especially in a lighter growing period under growth regulation, following heavy traffic, and when we have mowed very little as we raise the height up a 1/4" to 1 1/4" If that amount comes up during light growth, I can only imagine the amount that will arise during aggressive growth.

As mentioned, brushing was a common practice around pitches in Europe, as it is in golf course management. But in sports field management, it's not something that takes place a lot. After the observations of our 1st experience it will become a weekly practice followed with mowing with baskets for collection. I immediately am looking into tine harrows for additional fluffing and am sharpening the verticut blades as well. We think our program is aggressive enough but yet again we are wrong!

Following "Cultivated Thoughts on Thatch Management" and the results of core verifying our cool season turfgrass fields the week before a stretch of 100 degrees F (38 degrees C), I have spent more time examining the merits of core aeration. Certainly we as professional managers know the importance of core aeration. But with time constraints and all the other aeration options available to use today, coring is a bit less used. After the past few weeks, I am convinced that it is time to buck that trend and get back to the basics of core aeration.

Why do we core aerate? No it's not just to create overtime for ourselves and our work crews! Removing the column of soil from the profile makes a direct, open avenue for gas exchange in the soil. Water is able to infiltrate the profile easier, as well as the removal of thatch/ organic material/ soil that could be undesirable. Certainly solid tines open columns similarly, but they do so at the expense of compacting the soil around the column. Do not misunderstand me ANY type of aeration/venting that can be done at ANY time is essential to turfgrass survival, especially in high traffic field situations. But pulling cores is the most beneficial of all for gas exchange, thatch removal, and water infiltration into the top of the profile (deep tine aeration is a separate subject for deep water infiltration).

Basic teaching advocates core aeration 2 times a year. I have spent most of my career buying into that thinking, especially because of the intensity of the process. By now I am realizing that the benefits from core aeration are sometimes lost in the mess that is created from the aeration process. By the time the clean up process ends, we find ourselves swearing that we will never do it again. Last week alone we dulled a set of reels following clean up, then bent 2 reels from debris dropped during the coring and sweeping process. If I walked into the office this morning and declared we are core aerating again this week, there would be mutiny!

But outside on the fields the results are evident from the flush of fresh air into the rootzone and proper water infiltration. Green, strong, healthy turf looks like it was 50 degrees last night even though we spent the week in extreme heat.

Ironically as I was writing this, my colleague John Turnour made similar comments about his aggressive core aeration program at Nationals Park in DC. He too feels that the results are as dramatic as I do with the flush of air into the rootzone bringing an immediate plant response with green, vibrant growth and health. From a scientific standpoint, I am sure there is more to the response than just the air component nutrient availability especially. I will research this and let you know... I am intrigued to know myself.

In conclusion, the question becomes... how often does it need to be done? My new goal becomes 1 time a month in the growing season, skipping August unless it catches a cool stretch. So a total 6-8 times. That will total a removal of about 40% of the profile (@ 5% per time). We are at 2 with us to July, so hopefully we can finish at 6.

4 more times, oh boy; don't tell our work crews! ■

May 11

Friday marked the final day of my expedition in the United Kingdom. COLD was the theme of the day. With temperatures not rising above 45 degrees F, a breeze, and some rain showers; what a challenge to grow grass! Kudos to ALL the groundsmen in northern Europe. I have heard that it's cold in those areas and that is true!

The day started with a stop at historic Old Trafford. It is absolutely everything that is hyped. What a gorgeous and classic stadium. Thank you to Tony Sinclair, Head Groundsman at Old Trafford, for showing me around and sharing some absolutely fantastic ideas and thoughts on the success of maintaining such a wonderful pitch in the cold, wet conditions of the Manchester region. Tony's professionalism and fantastic attitude towards the challenges they face were extra motivating to me as we look at tackling the challenges daily faced with 22 pitches and all the events at SoccerPlex. The very best of luck to Mr. Sinclair and his tremendous staff with those upcoming challenges, including several matches for the Olympics.

Leaving Old Trafford, we headed over to Etihad Stadium, home of Manchester City. With both teams tied for the Premier League title going into the final weekend, it was absolutely amazing the experience the intensity and anxiety and the anticipation

>> **Top: LEE JACKSON,** head groundsman, Etihad Stadium, Manchester City, 2 days before Manchester City hosted and won the European Premier League championship.
>> **Bottom: MOWING** starting at Old Trafford.

in the air around both clubs. What a wonderful situation for Manchester as a city, no matter what side you are on. The world is talking about Manchester through Sunday!

The Head Groundsman for Etihad Stadium, Mr. Lee Jackson, took time to visit with us and show me around even with preparation ongoing for their final Premier League match on Sunday. Thank you to Mr. Jackson; I would like to think that I would do the same for a total stranger from out of the country if they came to visit me even during preparation for one of the biggest events of a lifetime. Mr. Jackson's pitch is superb. I am amazed how successful it's possible to be with growing grass through the dead of winter and into miserable weather conditions like they are experiencing in Manchester this spring.

Manchester United's Carrington Training Ground was the next stop. Mr. David Lindop was very generous with his time to welcome us and show me around as Head Groundsman Joe Pemberton was unavailable. Missing my friend Joe was the only disappointment of the trip. The training ground buildings are going through renovations and upgrades, as were many of the pitches. "Busy" is only half a strong enough word to describe how things are around the training ground. Thank you, David, for allowing me to spend some time with you and pick up many valuable lessons. Our conversations and seeing another piece of the renovation process was so helpful!

In route to the airport, our final stop in the Manchester area was at Salford City Stadium, a new rugby stadium. Mr. Danny Huffman, Head Groundsman, was in preparation for rugby events this weekend. With the stadium opening in the early winter, the pitch has been played on frequently during its few months. Mr. Huffman has succeeded to maintain a fantastic surface all the while establishing the young field even more. The pitch has Fibre Sand, so the opportunity to talk about the technology and get feedback surrounding the reinforcement was very, very helpful. Thank you for the time Danny it was extremely rewarding for me!

>> **PAUL BURGESS,** head groundsman, Real Madrid, on the day before Real Madrid's final match and presentation of their 32nd La Liga trophy.

Friday evening lead to the departure of Manchester with a flight down to Madrid, Spain. WOW it is HOT! Unseasonably warm weather is blessing Madrid and our trip; what a change from Manchester!

Thanks to Mr. Simon Gumbrill of Campey Turf Care for the hospitality, the guidance, and the wonderful feedback and wide range of ideas and discussions over the [past few days] traveling through 5 countries and several hundred miles, I am sure there are points he wanted to pull the car over or hit the eject button with all of the questions I was asking. Thank you, Simon, Richard Campey and the entire staff of Campey Turf Care for the respect, the time, the ideas, and the support. Absolutely a class act of an organization!

May 13

Well what a change from Manchester to Madrid. WOW it is almost HOT here! But I am not one to ever complain about heat so bring it on. It is refreshing!

Arriving in Madrid Friday night, many Thanks to Mr. Paul Burgess for taking the time to make a trip to the airport and then to show me around on Saturday. With preparation taking place for tonight's final La Liga match, after which Real will be presented with their 32nd league championship trophy, I know Mr. Burgess is very busy.

Saturday Paul was gracious enough to show me around on the pitch at the Bernabeu. WOW what a stadium. And WOW what a fantastic pitch. Absolutely great stuff. Following, Mr. Burgess gave the tour of the Real Madrid Training Ground. With the number of fields and tremendous about of place that takes place on each pitch, it reminded me even more of home. The observations and conversation created a wide range of new ideas for me. Thank you, Paul!

Now tonight, the fixture between Real Madrid and Mallorca. What an experience it shall be! Real is in the hotel here currently preparing for the match and what an atmosphere it is outside. So I can only imagine what it will be like at the Bernabeu tonight!

May 14

Returning to DC this afternoon, it's like I never left. Inconsistent weather continues! Examining the pitches at SoccerPlex this evening, we are still fighting the same inconsistent growth on cool season and bermudagrass. It's all good though we need the rain, and the sun looks to be coming by Wednesday.

Now that I am back home, the time for reflection and creating ideas begins. The key categories I have established to work through the many new topics and ideas currently are:

1) Professionalism. The professionalism exhibited by all the Groundsmen I met on the trip is amazing. They understand that extra traffic on a field is reality. So they spend their time working to negate it.

2) Confidence and aggressiveness. During the renovation process, most all fields are grown back from seed in 4 weeks time. If someone in the USA did that, we would think they had gone mad! I respect the confidence to do the "right thing" in using seed to eliminate the layering and to save money.

3) Self Sufficient and Efficient. Doing renovations "in house" on a rotating basis to achieve the end goal to using larger size equipment. Most all operations I observed were all about "getting things done" in an impressive manner.

4) Open Minded to new technologies (Desso, Fibre Sand, Crumb rubber, Fescue and Bluegrass w/ rye, performance testing, etc) and being tried and implemented daily.

May 15

A reason for the timing of my trip to Europe was that the playing season was wrapping up and the renovation season for the pitches is beginning. I wanted (or better stated, NEEDED) to see the renovation process taking place to get a better understanding of how it works and all the positive pieces of the process. My perception from the pieces of the process I had heard and read about were that the UK groundsmen must just really like to make themselves extra work! Ha ha. Why would you want to cut out your fields every year and wait for them to grow back in from seed? Madness! Well I certainly saw 1st hand and it was nothing like I imagined. Instead of madness, I say now that it is genius!

Quite a change huh? Let me try to explain the process and the goals.

Why renovate? To remove the poa annua plants and their seed bank (lack of chemical options for poa removal and control due to regulations). To remove the organic matter that has begun to build up during the growing season to completely avoid any layer that could cause a slick surface (core aeration and heavy topdressing can not be done frequently during the dead of winter during the season because the plant will not recover). And to create a more hardy and durable stand of grass plants (Plants that re-generate are stronger and resilient)

How to renovate? 1-Remove the top 1/8 to 1/2" of the pitch (termed "Fraze mowing"). 2-Proceed with a deep aeration (deep tine or Shock Wave). 3- Apply a layer of topdressing and/or run a Recycling Dresser to freshen up the soil base and create some loose material. 4-Drag a harrow across the surface to move around the loose material and fill in the low spots before the seeding takes place. 5-Seed, work in the seed and lightly topdress again. 6-Fertilize. 7-Grow. Four weeks later, the seed has germinated and is growing, and the hardy plants have re-generated and filled back in.

So then the question becomes does any of this process make sense in the United States. Your initial reaction is likely the same as mine-No! But then realize that no matter how good the poa controls supposedly are, that still don't really work and that we could be facing the same bans on pesticides in the future that they do in the UK .Think about renovating a football field in the spring (that needs spring time renovation anyway)/ to Fraze Mow Bermudagrass in the south that is over-seeded heavily and needs transitioning/ Renovate soccer fields that are used for spring and fall play/ Fraze mow the lips around the edge of baseball infield skins after the season. And we could sit and talk and come up with more and more where pieces of this process could fit in.

The boldest part, without a doubt, is to re-seed and not to sod. Adding the layer of soil in sod is obviously a challenge. And with a tool like the Recycling Dresser, that layer can be reduced much more quickly.

The boldest part, without a doubt, is to re-seed and not to sod. Adding the layer of soil in sod is obviously a challenge. And with a tool like the Recycling Dresser, that layer can be reduced much more quickly. But if and when a field has 6-8 week opening for a renovation, why not seed instead of sod? I am considering it; we are renovating our stadium field (because of poa) the last week of August. I can seed by the end of that week and have 6 full weeks before our next event. When I stop and think, of course it can be done but wow, that sure does take guts right! But to save $60k? Hmm

May 21

Professionalism is on my mind and ironically, multiple situations since my return have me glad it is the 1st topic. The traits I saw exhibited by all the groundsmen I met on the trip are amazing. The "technical or ethical standards" of our profession are being created by these men. Placed under such impossible demands from weather and from traffic, they are setting the standards the rest of us are characterized by or conforming to. Pitch quality continues to rise, and less than perfect is absolutely unacceptable even if the weather or challenge could be used a plausible excuse for them.

These professionals understand that extra traffic on a field is reality so they spend their time working to figure out how to produce the best turfgrass possible with a positive, "get it done" attitude. Negativity does not exist. The challenge is respected.

With the examples that I observed from the European experience, I continue to think about how I can help our operation at Maryland SoccerPlex set a stronger example of professionalism.

May 24

Confidence and aggressiveness. It's [often said] in American sports, “Offense wins games, defense wins championships." But is that really true? Defense is great until you meet a better offense.

I am thinking "offensively" after visiting with so many fantastic European groundsmen. There is such a confidence, assurance, and matter of fact approach to management. There is no fear. Or if there is, they certainly do not show it! To strip off a field and re-seed instead of sod seems like insanity to us; it’s common place for them. Here playing tennis on grass seems impossible; they do it all the time. Here roofs on grass stadiums are few and far between; there every stadium there has a roof. Here extra events on a field cause stress; they welcome it as an opportunity to try something new. They seem to always be on the offensive, working toward the next goal.

Before my trip, I felt my management philosophy for turfgrass was aggressive and simple: the grass has 2 choices, grow or die. After visiting Europe though I realize it’s not that simple. Many decisions are from a "defensive" or conservative stand point. These decisions are still GOOD decisions. But they are made from a "what if" perspective with anxiety, uneasiness, hesitation, and even lack of confidence play into the decision-making process. The process is complex. It's "Defensive."

"Offensive" decision-making becomes less complex. Mother Nature provides challenge, but the strong turf can overcome. We sleep better at night with less stress!

May 27

Thank you to everyone who has been engaging me in thought-provoking discussion over each of the points of focus from my European trip. So many good ideas continue to flow and already they are making a difference in our maintenance program here at SoccerPlex.

The 3rd point to discuss is the manner in which several of the European sports field operations run so self-sufficiently and how they are highly efficient in all of their tasks. With training grounds similar to the size of the 22-field Maryland SoccerPlex, several of the operations that I observed are similar to ours. However, ultimately, their operations run very differently.

Many of the major maintenance and renovation techniques that take place in Europe are done in-house by field maintenance crews. Specialized contractors are still involved, but many operations have their own equipment to do the tasks on their own as well.

The European operations are more self-sufficient partially because they are so efficient as well though. Tractors in the 100 hp range are not uncommon. A 63-inch aerator (our biggest) is small by Euro standards. From a manpower stand point, they are able to get many more tasks completed with fewer people because fewer hours are spent in operation of equipment. The extra time equates into the ability to accomplish more tasks in-house. It seems so simple, but yet it seems so ingenious! Especially with the security of completing tasks such as aeration more quickly- 1 aeration cycle takes up to 2 week for our Soccer-

Plex crews to finish. Staggered staffing and overtime make up the time to finish each cycle because 2 weeks un-interrupted by weather or play does not exist. Increased efficiency reduces those challenges.

This discussion ultimately connects us back to my previous post on confidence and aggressiveness. Taking on such tasks such as renovation in-house is a large undertaking! As is the operation of larger equipment. But in the end, it establishes a maintenance program that is absolutely always on "offense"!

May 29

Having an open mind is important when it comes to evolution of a turfgrass maintenance program. The European market is full of technologies that stem from open minds that are always improving the quality of the pitches. The following ideas are things that I viewed:

Desso Grassmaster: A reinforcement system with synthetic fibers sewed into the sand profile of a natural grass field. A few fields in the US use the technology, but it has not caught on because the fibers make it impossible to sod into, so seeding is required for renovations.

Fiber sand: A reinforcement system with synthetic fibers mixed into the sand profile to reduce compaction potential and provide stability in sand. Our stadium pitch at SoccerPlex has fiber sand and we have fantastic results. Again, this is not a system that is common in the US. But the potential for it is big. The success stories are endless with using the product and managing it correctly.

Crumb rubber on sand for cushion: Many facilities use crumb rubber topdressing to attempt to soften the goal mouths and goal keeping practice areas. I have considered crumb rubber for the same, but also to help to reduce compaction and to add heat to bermudagrass fields more quickly in the spring. Mixed results are being found with crumb rubber... so the jury is still out.

Fescue into ryegrass: Turf type tall fescue genetics have created a superior plant that is able to be used in a ryegrass and/or bluegrass stand. Some of the fescues that I observed are absolutely fantastic especially blended with ryes for more wear tolerance. With that, we used fescue to overseed our bermudagrass last fall/ this spring, and it is by far the most durable overseeding we have ever had.

Performance testing: During several visits, testing officials from the Sports Turf Research Institute were on site doing performance testing of the turfgrass stand. Infiltration rates, compaction/ hardness testing, ball speed, tinsel strength, root depths, etc, etc. I know of a few tests that we have done/can be done in the US, but I know of no one testing religiously to give an established baseline of conditions during the season. It is a perfect way, in conjunction with tissue and soil testing, to know how well changes in a maintenance program work!

These, and many other open minded ideas, were common place in discussions and maintenance programs around Europe. Other technologies like SubAir, glycol heating, and most importantly, grow lights, make growing turfgrass in challenging conditions more successful. Combine those ideas with the aggressive nature of the complete renovation each year. It would see that here in the US we are lagging behind on creating new create, open minded ideas. With that, do we have things to learn from our European counterparts? I say YES. ■

Calibration & safety of pesticide application equipment

Calibration accuracy and personal safety associated with pesticide application is key to a successful pesticide program.

HOW TO USE THE WORKSHEET (FIGURE 1)

Nozzle Uniformity

1. Enter date, nozzle code and sprayer operating pressure in appropriate box. Verify that all nozzles are the same type and size along the boom.

FIGURE 1

NOZZLE UNIFORMITY AND CALIBRATION WORKSHEET

DATE_____

NOZZLE CODE = _____ PRESSURE = _____

(Volume Conversion) NOZZLE DECIMAL OUTPUT X 128 = _____ OUNCES

NOZZLE CATCH TIME IN SECONDS = _____

#1_____	#5_____	#9_____
#2_____	#6_____	#10_____
#3_____	#7_____	#11_____
#4_____	#8_____	#12_____

AVERAGE OUTPUT _____ OUNCES

AV. OP. X 0.95 = _____ (-5%) AV. OP. X 1.05 = _____ (+5%)

CLEAN OR REPLACE NOZZLE NOT WITHIN 5% OF AVERAGE, REPLACE ALL IF TWO OR MORE ARE WORN.

****

GALLONS PER MINUTE = $\frac{\text{Ozs. X 60}}{\text{Sec. X 128}}$ = _____ = _____ (GPM)

VEHICLE SPEED = $\frac{.682 \text{ X Ft.}}{\text{Seconds}}$ = _____ = _____ (MPH)

NOZZLE SPACING IN INCHES = _____ (W)

CALIBRATION RATE IN GALLONS PER 1,000 Sq. Ft. = $\frac{136.36 \text{ X GPM}}{\text{MPH X W}}$ = _____ = _____ (GPK)

(To Calculate Gallons per Acre: Substitute 136.36 with 5,940)

or

Multiply GPK X 43.56 = _____ (GPA) Gallons per Acre

****

ACCEPTABLE ERROR RANGE = GPK (GPA) X 0.95 = _____ (-5%)
(Target Area vs Sprayed Area)

GPK (GPA) X 1.05 = _____ (+5%)

2. Catch the flow from each nozzle for exactly the same amount of time. The number of seconds used is usually between 20 and 60, but make sure that at least 20 ounces are collected in each calibration jar (to help reduce error size). It is very important to maintain a constant operating pressure throughout the entire operation. Enter catch times in appropriate boxes.

3. Calculate average nozzle output.

4. Determine if any nozzles are significantly worn or clogged by verifying that all flow rates are within + or - % of the average nozzle output. (Typically between 5-10% limit.)

5. Clean, replace or recheck nozzles exceeding the predetermined limit.

Speed Calculator

1. Calculate field spraying speed of the machine by laying out a level test course at least 100 feet long (Use a turf area, not a parking lot or cart path). Fill machine ½ full of water to simulate average load and record the exact amount of seconds to travel entire course at operating speed. Use this data in the equation provided.

Application Rate

** GPM and Speed calculations should appear in appropriate boxes (from previous formulas).

1. Measure nozzle spacing in inches. Enter number (in inches) in box.

2. Calculate the calibration rate using the formula provided. Read the product label to determine if this calibration rate falls within guidelines. Use manufacturer's catalogue charts to help verify your calculations.

NOZZLE SELECTION AND SIZING (FIGURE 2)

1. Determine the recommended calibration rate. (Refer to product label.)

2. Measure nozzle spacing in inches.

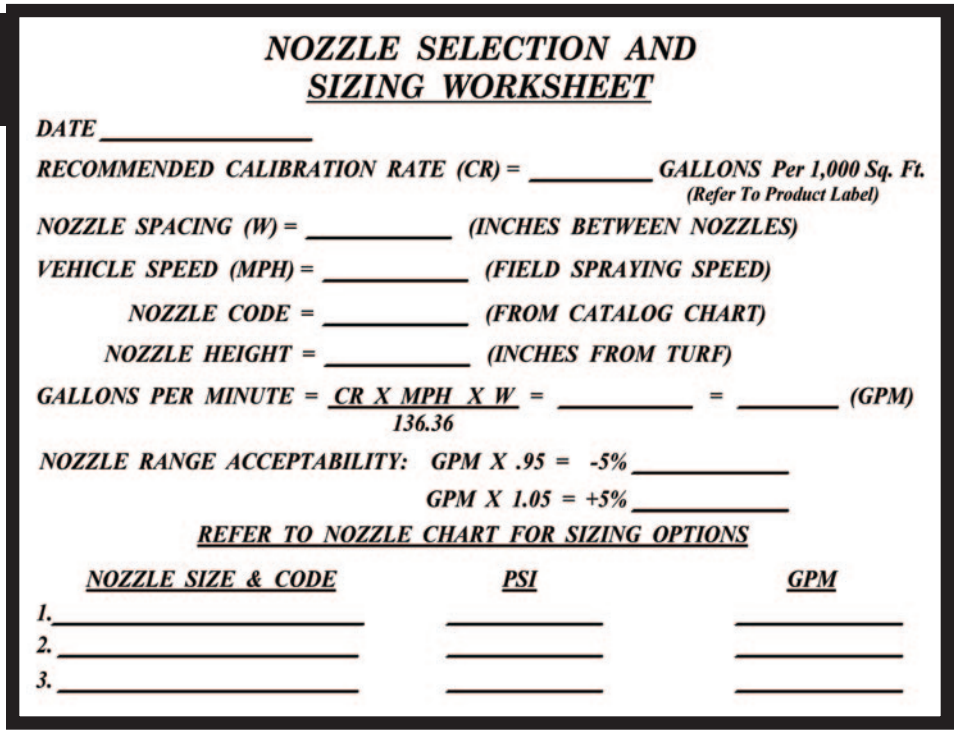
3. Determine the spraying speed you will be using in the field.

4. Determine the appropriate nozzle size from manufacturer's charts.

5. Calculate the nozzle flow rate necessary to achieve the desired calibration rate with the sprayer.

6. Use nozzle manufacturer's catalogue to determine the nozzle identification code that corresponds to the nozzle style and

FIGURE 2



NOZZLE SELECTION AND SIZING WORKSHEET

DATE _____

RECOMMENDED CALIBRATION RATE (CR) = _____ GALLONS Per 1,000 Sq. Ft. (Refer To Product Label)

NOZZLE SPACING (W) = _____ (INCHES BETWEEN NOZZLES)

VEHICLE SPEED (MPH) = _____ (FIELD SPRAYING SPEED)

NOZZLE CODE = _____ (FROM CATALOG CHART)

NOZZLE HEIGHT = _____ (INCHES FROM TURF)

GALLONS PER MINUTE = $\frac{CR \times MPH \times W}{136.36}$ = _____ = _____ (GPM)

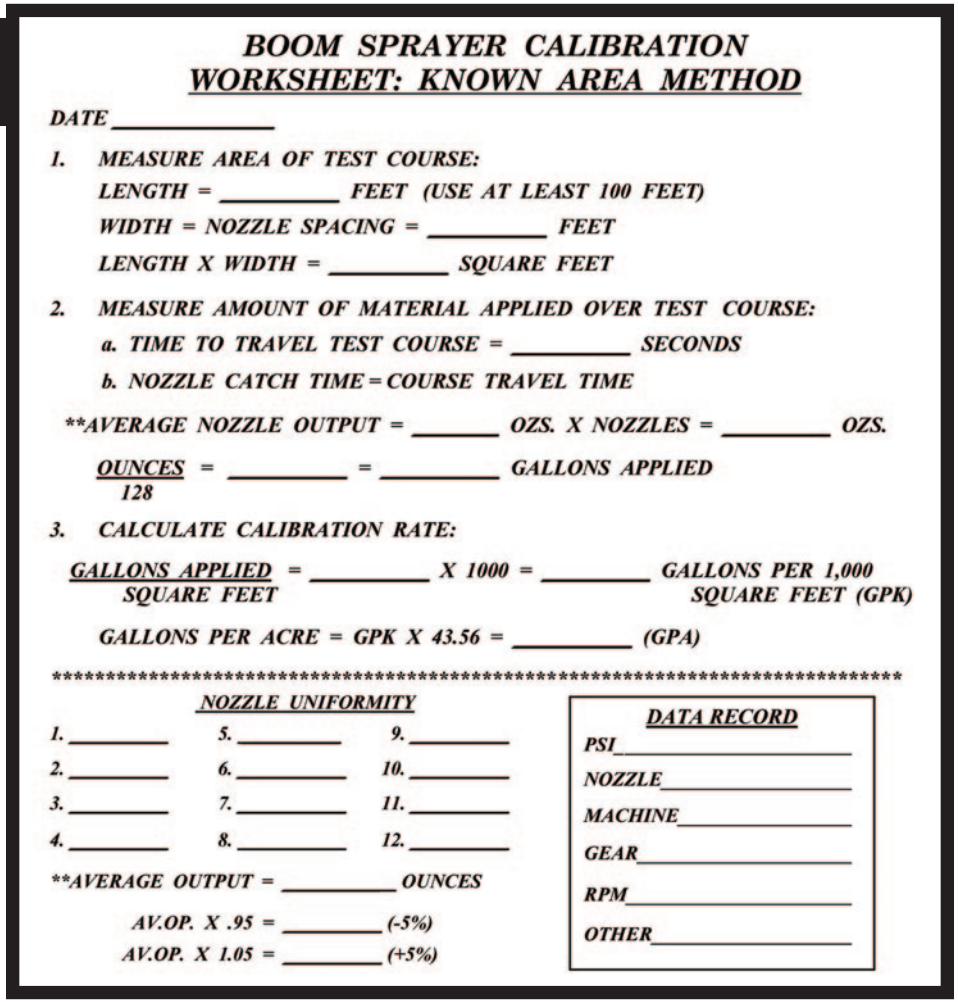
NOZZLE RANGE ACCEPTABILITY: GPM X .95 = -5% _____

GPM X 1.05 = +5% _____

REFER TO NOZZLE CHART FOR SIZING OPTIONS

NOZZLE SIZE & CODE	PSI	GPM
1.		
2.		
3.		

FIGURE 3



BOOM SPRAYER CALIBRATION WORKSHEET: KNOWN AREA METHOD

DATE _____

1. MEASURE AREA OF TEST COURSE:
   LENGTH = _____ FEET (USE AT LEAST 100 FEET)
   WIDTH = NOZZLE SPACING = _____ FEET
   LENGTH X WIDTH = _____ SQUARE FEET

2. MEASURE AMOUNT OF MATERIAL APPLIED OVER TEST COURSE:
   a. TIME TO TRAVEL TEST COURSE = _____ SECONDS
   b. NOZZLE CATCH TIME = COURSE TRAVEL TIME

**AVERAGE NOZZLE OUTPUT = _____ OZS. X NOZZLES = _____ OZS.

$\frac{OUNCES}{128}$ = _____ = _____ GALLONS APPLIED

3. CALCULATE CALIBRATION RATE:

$\frac{GALLONS\ APPLIED}{SQUARE\ FEET}$ = _____ X 1000 = _____ GALLONS PER 1,000 SQUARE FEET (GPK)

GALLONS PER ACRE = GPK X 43.56 = _____ (GPA)

****

NOZZLE UNIFORMITY

1. _____	5. _____	9. _____
2. _____	6. _____	10. _____
3. _____	7. _____	11. _____
4. _____	8. _____	12. _____

**AVERAGE OUTPUT = _____ OUNCES

AV.OP. X .95 = _____ (-5%)

AV.OP. X 1.05 = _____ (+5%)

DATA RECORD

PSI _____

NOZZLE _____

MACHINE _____

GEAR _____

RPM _____

OTHER _____

flow rate chosen for the equipment.

7. Follow nozzle manufacturer's recommendation for proper nozzle height.

BOOM SPRAYER CALIBRATION: KNOWN AREA METHOD (FIGURE 3)

1. Measure a level test course at least 100 feet long on a turf area (not a parking lot or cart path). The width of this test course will be the spacing between each nozzle in feet.

Nozzle Spacing in Inches divided by 12 = Test Course Width in Feet. Total square feet of the area is Length X Width.

2. Fill machine 1/2 full of water to simulate average load and record the exact number of seconds to travel the entire test course at normal operating speed. Use a calibration jar to collect the flow from each nozzle for the same amount of time it took to cover the test course. Calculate the average nozzle output and replace or clean any nozzle with a flow rate not within 5% of the average. Average Nozzle Flow in Ounces divided by 128 oz. per gallon = Average Gallons Applied

3. Record all data for future use. Calculate your + or - 5% acceptable error range (Target Area vs. Sprayed Area). Each time you use your sprayer, the calibration rate must fall within these values. Either repair or replace components causing calibration rate inaccuracy.

TIPS: Check for wear more frequently when spraying wettable powders. Verify the accuracy of your measuring devices.

EASY METHOD SPRAYER CALIBRATION (128TH ACRE TEST)

1. Fill spray tank with clean water.

2. Verify that spacing between nozzles is equal (record in inches).

3. Perform nozzle uniformity test.

4. Measure test course. (Use chart below or formula to determine course length.) (Formula: 4080 / Nozzle Spacing in Inches = Test Course in Feet.)

5. Drive the test course at your normal spraying speed and record travel time in seconds.

6. Park sprayer while maintaining the same engine RPM used to drive the test course.

7. Set pressure to be used while spraying.

8. Collect the output from one nozzle for the same amount of time it took to travel the course.

9. Each ounce collected equals a gallon per application rate. (Example: 52 ounces collected equals 52 gallon per acre application rate)

Nozzle Spacing - Test Course Chart	
Nozzle Spacing (Inches)	Test Course Length (Feet)
20	204
18	227
16	255
14	291
12	340
10	408

TANK MIXING (FIGURE 4)

1. Determine the recommended application rate from the product label. This value can be in fluid or dry ounces.

2. Enter the calibration rate measured from the sprayer.

3. Calculate the product per gallon ratio according to the worksheet.

4. Calculate the amount of product required for each tank or partial tank. Before adding product, you should fill the tank 1/2 full of water and begin agitation. After product's been added, bring tank up to desired level/volume.

For planning purposes, it may be useful to calculate the following:

5. Estimate the area to be treated. This value will be slightly larger than actual green or fairway size due to overspray of irregular areas.

6. Estimate the total water requirements. You can use this figure to determine how many spray tanks the application will require.

7. Estimate the product requirements and check if supplies are adequate before mixing.

TIPS: Verify the markings on your spray tank for accuracy and use a dipstick or flow meter to measure partial tanks. Do

FIGURE 4

TANK MIXING WORKSHEET

*DATE*_____

*PRODUCT NAME*_____

PRODUCT LABEL RATE = _____ *OUNCES PER 1,000 SQUARE FEET*

ACTUAL CALIBRATION RATE = _____ *GALLONS PER 1,000 SQUARE FEET*

PRODUCT PER GALLON = $\frac{\text{PRODUCT LABEL RATE}}{\text{CALIBRATION RATE}}$ = _____ *OUNCES OF PRODUCT PER GALLON OF WATER*

AREA TO BE SPRAYED (estimated) = _____ *1,000 SQUARE FEET*

TOTAL WATER REQUIRED = CALIBRATION RATE X AREA TO SPRAY = _____

TOTAL PRODUCT RQUIRED = PRODUCT RATE X AREA TO SPRAY = _____

****

PRODUCT IN TANK # 1 = GALLONS OF WATER X PRODUCT PER GALLON

(If Required, Calculate Additional Tank Mixes)

PRODUCT IN TANK # 2 = GALLONS OF WATER X PRODUCT PER GALLON

FIGURE 5

CALIBRATION:
ADVANCED SECTION WORKSHEET

DATE _____

1. *CALIBRATE THE MPH YOU NEED TO GET EXACTLY 2.0 GALLONS PER 1,000 SQUARE FEET.*

2. *CALCULATE THE GPM NEEDED FOR 2.0 GALLON PER 1,000 SQUARE FEET. DO YOU NEED TO SELECT A LARGER VOLUME NOZZLE?*

3. *CALCULATE THE ACTUAL NOZZLE PRESSURE.*
   (Refer to Nozzle Manufacture's Flow Chart)

$$\frac{GPM_1}{GPM_2} = \frac{\sqrt{PSI_1}}{\sqrt{PSI_2}}$$

not mix more solution than is required for the operation.

INSTRUCTIONS FOR THE ADVANCED SECTION (FIGURE 5)

You've measured the actual calibration rate of the sprayer. You want to spray a calibration rate of 2.0 gallons per 1000 square feet. Determine how to make the adjustments in question #1 and #2.

1. If you only want to change your sprayer speed to achieve the new calibration rate, how fast would you need to go? MPH = 136.36 X GPM divided by CR x W

2. Instead of changing your speed to achieve a new calibration rate, you decide to change only nozzle flow. What is the new GPM? Do you need to select a larger nozzle or just change the pressure? GPM = CR X MPH X W divided by 136.36

3. This is a useful method to calculate your actual nozzle operating pressure. The formula allows you to compare field measurements to nozzle performance charts. This calculation is used primarily to track the amount of pressure drop in your sprayer.

GPM (1) = Measured nozzle flow from sprayer (Actual Catch).

GPM (2) = Flow rate from nozzle performance chart.

PSI (1) = Actual nozzle operating pressure. PSI (1) is X, the unknown value. Find X to solve the equation.

PSI (2) = Nozzle pressure from chart that corresponds with GPM (2).

LAWN GUNS, BACKPACK AND BOOMLESS SPRAYER CALIBRATION (FIGURE 6)

1. Pick a level turf area and mark a rec-

FIGURE 6

LAWN GUNS, BACKPACKS and BOOMLESS SPRAYERS CALIBRATION WORKSHEET: KNOWN AREA METHOD

DATE _____

1. MEASURE AREA OF TEST COURSE:
   LENGTH = _____ FEET
   WIDTH = _____ FEET
   LENGTH X WIDTH = _____ SQUARE FEET
2. MEASURE AMOUNT OF MATERIAL APPLIED OVER TEST COURSE:
   a. TIME TO TRAVEL TEST COURSE = _____ SECONDS
   b. NOZZLE OUTPUT (catch time-same as travel test course) = _____ OUNCES

   $\frac{\text{OUNCES}}{128} = \frac{\quad}{128} =$ _____ GALLONS APPLIED
3. CALCULATE CALIBRATION RATE:
   $\frac{\text{GALLONS APPLIED}}{\text{SQUARE FEET}}$ = _____ X 1000 = _____ GALLONS PER 1,000 SQUARE FEET (GPK)
   GALLONS PER ACRE = GPK X 43.56 = _____ (GPA)

USEFUL FORMULAS

$\frac{\text{OUNCES}}{128} = \text{GALLONS}$

GALLONS Per 1,000 Sq. Ft. X 43.56 = GALLONS Per ACRE

DATA RECORD

PSI _____
NOZZLE _____
SPRAYER _____
OTHER _____

FIGURE 7

SPREADER CALIBRATION WORKSHEET: KNOWN AREA METHOD

DATE _____

1. MEASURE AREA OF TEST COURSE:

   LENGTH = _____ FEET

   WIDTH = _____ FEET

   LENGTH X WIDTH = _____ SQUARE FEET

2. MEASURE AMOUNT OF MATERIAL APPLIED OVER TEST COURSE:

   MATERIAL WEIGHT PRIOR TO APPLICATION = _____ POUNDS

   MATERIAL WEIGHT AFTER APPLICATION = _____ POUNDS

   TOTAL AMOUNT OF MATERIAL APPLIED = _____ POUNDS

3. CALCULATE CALIBRATION RATE:

   POUNDS APPLIED / SQUARE FEET = _____ X 1000 = _____ POUNDS PER 1,000 SQUARE FEET

   POUNDS PER 1,000 SQUARE FEET X 43.56 = _____ POUNDS PER ACRE

USEFUL FORMULAS

OUNCES / 16 = POUNDS

GRAMS / 454 = POUNDS

DATA RECORD

SPREADER_____

SETTING_____

MATERIAL_____

PASS WIDTH_____

MACHINE_____

GEAR_____

RPM_____

OTHER_____

Pesticide Compatibility

- Read Product Label
  - Review formulation compatibility statements
- Jar Test
  - Use a 1-quart clear glass jar and add 1-pint of clear water
    - add 1-1/2 teaspoons for each pound per acre recommended of the wettable powder
    - followed by 1 teaspoon for each quart per acre recommended of the liquid pesticide
    - shake the jar and let it stand for 2-3 minutes
    - if pesticides are non-compatible;
      - products may separate and form layers *or* a greasy film will form in the mixing container

Note: In some cases a compatibility agent can be added to solve the problem

TIPS:

Maintain a constant operating speed and pressure throughout entire application. Verify the accuracy of your measuring devices. Calibrate your equipment at the same speed, pressure and overlap as you will use in the field.

tangular test course (length X width - square feet) of approximately: 500-2,000 square feet for backpack sprayers and lawn guns, and 20,000-40,000 square feet for boomless sprayers.

2. Measure the exact amount of time to travel the test course under normal spraying conditions. Use a catch can or bag and calibration jar to measure nozzle flow in ounces from the machine for the same exact amount of time it took to cover the test course.

Ounces collected divided by 128 ounces = Gallons applied over test course

3. Calculate the calibration rate according to the worksheet and use it for tank mixing.

4. Record all data for future use.

TIPS: Maintain a constant operating speed and pressure throughout entire application. Verify the accuracy of your measuring devices. Calibrate your equipment at the same speed, pressure and overlap as you will use in the field.

SPREADER CALIBRATION (FIGURE 7)

1. Select a level area, preferably covered with turf and mark a rectangular test course of approximately: 1,000-5,000 square feet for small spreaders, and 10,000-40,000 square feet for larger spreaders.

2. Measure the exact amount of material applied over the area.

This can be done by:

A. Place a (weighed) known amount of material in the spreader. Re-weigh the material left in the spreader after completing the test course; or B. On larger machines, it may be necessary to place calibration marks on the spreader bin or place. A known amount of material in the spreader and measure the total area covered after all material is used.

3. Calculate the calibration rate according to the worksheet.

4. Record all data for future use.

TIPS: Maintain a constant operating speed throughout application. Flow rate and distance of throw vary according to the size and weight of the material. Follow manufacturer's recommendations for overlap. If unavailable, determine the amount of overlap required by placing a series of catch cans perpendicular to spreader travel and measuring the application pattern or use between 75-100% overlap of the width of throw.

Spreader Calibration: Known Area Method

Single Pass Calibration

Measure area of test course…

Test Course Length (ft.) **x** Effective Pattern Width (ft.) = Total sq. ft.

Example: 25 ft. length **x** 5 ft. effective pattern width **=** 125 square feet

Note: Rotary / Broadcast spreader effective pattern width is typically between 75% - 100% less than the overall pattern width.

I.e.: overall pattern width = 10 feet; effective pattern width = 5 feet

1. **Set the rotary spreader's rate gate opening to the recommendation published on the fertilizer bag (*per spreader brand, model, etc.*).**
2. **Partially fill the spreader with a pre-weighed amount of fertilizer to be used in the application.**
3. **Walk at *your* normal application pace. Achieve your application pace several feet before crossing the test course "Starting-line" and maintain your application pace several feet after crossing the test course "Finish-line".**

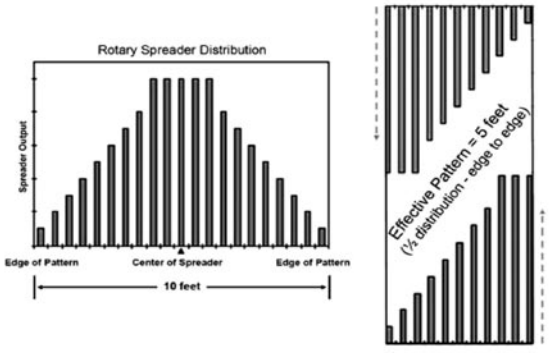
*** Turn the spreader on when the wheels are directly over the "Starting-line"… … (*example: 0 feet*).**

*** Turn the spreader off when the wheels are directly over the "Finish-line"… … (*example: 25 feet*).**

4. **Weigh the amount of fertilizer left in the spreader and subtract that amount from the pre-weighed amount.**

Note: A fraction of an ounce digital or analog scale is required for Single Pass Calibration.

Rotary Spreader Effective Pattern



SAFETY—THE "THREE C'S" PROGRAM

Control the spill. Immediate steps must be taken to control the spill. Make sure you are properly protected, isolate the area, avoid contact with the material, drift, or fumes, and evacuate any nonessential people from the area. Do not leave the spill unless someone can relieve you, preferably someone who has "Three C's" training. Once the spill is under control, get help immediately and notify your supervisor. Depending on the size of the spill, you may need to contact "HAZMAT", police, fire and rescue units, and the Dept. of Natural Resources.

Contain the spill. Contain the spill in as small an area as possible. Use a rake or a shovel to make a dam or dike around the spill to keep it from spreading. Block off any ditches or depressions in the area of the spill to insure the spill's containment. Do not allow the flow of material to reach any bodies of water.

Liquid pesticide spills can be further contained by the use of absorbent materials such as sand, sawdust, kitty litter or absorbent pads. Before using absorbent material, make sure the chemical is compatible with the absorbent material used. A reaction may occur between the spill and the material used to clean up the spill. Pesticides with strong oxidizers may create a fire when mixed with sawdust, thereby compounding an existing problem. (Chlorites in some herbicides and ammonium nitrate in some fertilizers are two examples of oxidizers.)

Dry pesticide spills can be contained by lightly misting the material with water, or by covering the spill with plastic.

Clean up the spill. Liquid: Spread absorbent material over the contaminated area, sweep it up and place it in a heavy-duty plastic bag. Repeat this procedure until the spill is cleaned up.

Dry: Material must be swept up and reused if possible. If material gets wet, becomes contaminated with soil or other debris, it must be swept up and placed in a heavy-duty plastic bag.

To decontaminate or neutralize the area, mix full strength, ordinary household bleach and hydrated lime. Wear protective clothing and work the preparation into the spill area with a course broom. Place the contaminated preparation in a heavy-duty plastic bag. Repeat this procedure several times to insure neutralization of the pesticide. Never hose down the contaminated area to dilute the pesticide. Activated charcoal can be used to minimize significant plant injury in smaller spills. Charcoal can tie up or absorb enough chemical to reduce long-term contamination.

Soil contamination: Remove the top two or three inches of soil, cover with at least two inches of lime and cover the lime with fresh top soil. Dispose of the contaminated soil.

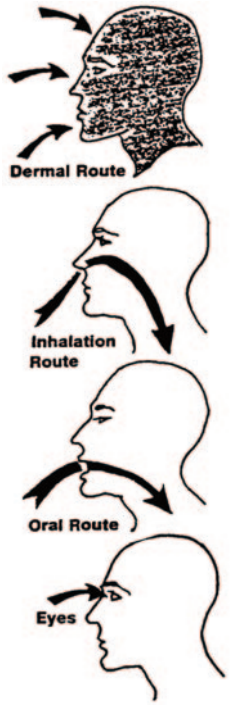
Clean or dispose of all equipment and materials used in the clean up in a manner consistent with label requirements and any EPA, local or state regulations.

All materials used to control, contain, and clean up a pesticide spill must be handled as hazardous waste and must be disposed of in a manner consistent with the label requirements and any EPA, local or state regulations. ■

Jim Nedin has been associated with the turf industry for 40 years. He began his professional career as a golf course superintendent in the early 70's and has taught turf industry related seminars for 30 years. Jim is a private service business consultant, and is currently working with select Toro distributors and The Toro Company, providing technical service support and training, jimwex2@gmail.com.

Routes of pesticide exposure

TO EFFECTIVELY GUARD AGAINST PESTICIDE EXPOSURE, we must first realize the risk involved when handling pesticides and how they enter our bodies.



FOUR ROUTES OF ENTRY

- **Dermal**. Studies show that about 97% of all pesticide exposures occur through contact with the skin. This absorption is accomplished by careless handling, while mixing or loading, applying or disposing of pesticides and their containers. The most common of these would be splashes, spills, or drift, while mixing or loading (handling the pesticide in its most concentrated form).

- **Inhalation**. We all know that the lungs oxygenate our blood. So if we inhale a sufficient amount of a pesticide into our lungs, complete and rapid pesticide poisoning will occur when the blood passes through our lungs then out, to travel in the blood stream throughout the entire body. Poisoning by inhalation is not limited by any means. Damage to tissue in the nose, throat, and lungs can also produce long-term health problems and illnesses.

- **Oral**. More often than not, children are victim of this type of exposure, greatly due to a careless applicator or even a parent who has removed a pesticide from its original container and put it into an unmarked bottle or other storage container. However, for our purposes, one must realize that oral exposure can occur with a simple lick of the lips, smoking, chewing (tobacco or gum), eating or drinking, while handling pesticides.

- **Eyes**. The eye though very small can absorb enough pesticide to be significantly hazardous. Poisoning here is most generally accomplished through the rubbing of one's eyes with contaminated hands. Spills, splashes and drift are also methods of entry to guard against.

TOXICITY (LD50, LC50)

What do we need to know about these two numbers? Simply put, the higher the LD50 or LC50 number, the lower the incidence of poisoning has occurred in laboratory testing of that pesticide. On the other hand, the lower that number, the greater the incidence of poisoning has occurred in lab testing, and those pesticides will generally carry a signal word of "Danger." Signal words are derived from LD (lethal dose) or LC (lethal concentrate) numbers, so if you can't find one of these numbers on the label, or MSDS, follow the signal word precautions.
For personal safety, always wear protective gear and always wash up immediately following contact with any pesticide.

Personal protective equipment

YOU NEED TO DECIDE! Read the label. The formulation, signal word, precautionary statements, personal protective equipment statements, the application method, and the projected length of exposure indicate the personal protective equipment you need.

MINIMUM EXPOSURE

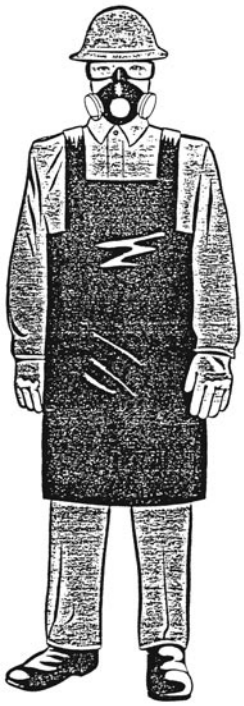
- (Such as granular applications and many other routine pesticide activities.)
- Protective suit (such as fabric coveralls) worn over normal work clothes.
- Chemical-resistant gloves such as rubber, vinyl, or plastic (never use fabric, leather, or paper gloves).
- Socks and shoes or boots

MAXIMUM EXPOSURE

- (Such as direct contact with drenching spray, mist blower or knapsack applications, or handling very highly toxic pesticides.)
- Chemical-resistant hood or hat
- Goggles or face shield
- Respirator (if the label requires it or if dusts, mists, fogs, or vapors will be generated).
- Chemical-resistant protective suit worn over normal work clothes.
- (A chemical-resistant protective suit may cause heat stress under some conditions.)
- Chemical-resistant gloves such as rubber, vinyl, or plastic (never use fabric, leather, or paper gloves).
- Chemical-resistant boots or footwear (never wear leather or canvas footwear).

Handling Concentrates

- This is the minimum protective clothing and equipment you should wear while mixing and loading pesticides which are moderately to highly toxic.
- Protective suit (such as fabric coveralls) worn over normal work clothes.
- Chemical-resistant apron
- Chemical-resistant gloves such as rubber, vinyl, or plastic (Never use fabric, leather or paper gloves)
- Chemical-resistant boots or footwear (Never wear leather or canvas footwear)



- Face Shield or goggles
- Respirator
(If the label requires it)