opment of a good cultural aeration program, the issues to consider and the benefits of a comprehensive program.

Then, John Foster of West Coast Turf discussed the basics of big roll sod installation, explaining the long rolls can be harvested in thicknesses up to two inches. Since these rolls are so heavy, laying them accurately the first time is crucial. He covered selection, soil preparation, installation and irrigation techniques.

After a short break, seminar sessions started again at 10 a.m. as Bill Murphy — parks recreation manager for the City of Scottsdale, AZ, the spring training home of the San Francisco Giants — covered infield maintenance. He discussed the tools, materials, and maintenance levels involved, then moved into step-by-step procedures for daily field preparation and game day preparation.

Then Steve Wightman, stadium turf manager for San Diego's Jack Murphy Stadium, discussed the basics of pitching mound construction and maintenance as a lead-in to the afternoon's hands-on demonstrations. He noted that it's the most concentrated wear area on a baseball field and must receive constant maintenance to provide a safe, firm and consistent platform for pitchers to deliver their pitches.

After a break for lunch and time in the trade show area, the group observed field demonstrations of deep-tine aeration, baseball outfield maintenance, big roll sod installation, and the construction and maintenance of infield skirts, mounds and bullpens.

West Coast Turf provided 8,000 square feet of hybrid bermudagrass sod overseeded with perennial ryegrass — and the equipment and a full crew to install it.

Stabilizer Inc. provided 48 tons of Stabilizer Infield Mix, delivered on site.

Enviable Greens provided deep-tine aeration of the outfield.

A-1 Soils Company provided five tons of mound mix.

The Men's Senior Baseball League supplied three professional pitching rubbers.

Dave Ashman of Ashman & Associates provided a field maintenance handbook.

And, AR Vertebrate provided pest control for pocket gophers.

Steve Wightman switched to his "show and tell" mode to demonstrate when and how to measure a field and the intricacies of mound construction. He also supervised the sod cutting around the mound and at the basepaths, and did a hundred other things.

Besides these donations, the other seminar presenters and the seminar attendees pitched in with their own hands-on labor.

Wightman even put Executive Director Trusty to work, teaching him the ropes of mound building. Says Trusty, "Wow! You can't top learning from a master. It was a super experience for me!"

The infield was completely redone, with the group building the pitching mound and batter's box, reworking the skinned area and resodding the infield turf. The mounds in both bullpens were rebuilt.

Dennis Snell, who is the softball coach and in charge of maintenance for all the school's athletic fields, took part. Baseball head coach Steve Hargrave, who helps maintain the field and build the mounds, and assistant baseball coach Steve Riehle also joined in these sessions.

Snell called the two day program a great opportunity for him to reinforce things he was already doing and to learn, hands on, techniques to keep a field in top condition.

Although the Saturday follow-up work crew was smaller, Steve Wightman kept them hopping until the infield reached premium condition.

School principal "AJ" Allan Johnson notes, "This terrific project was a once in a lifetime opportunity for the school." The field is also used by an adult league. Those school personnel see a topnotch field as a source of community, as well as school, pride.

Special thanks go to So-Cal Chapter's president, Chris Bunnell, who spearheaded and coordinated this project — and pitched in to help as well.

STMA Chapter News

Iowa STMA: The Iowa Sports Turf Managers Association's Annual Membership Meeting begins at 3 p.m. on January 28 at the Des Moines Convention Center. The meeting and special sports turf sessions are held in conjunction with the 63rd Annual Iowa Turfgrass Conference and Trade Show, January 27-29, 1997.

A Sports Turf Workshop will be held on Monday, January 27, from 8:30 a.m. to 4 p.m. January 28th's general sessions begin at 8 a.m. The afternoon sports turf sessions begin at 1:30 p.m.

On January 29, general sessions begin at 8 a.m. with sports turf sessions starting at 10 a.m. Continuing pesticide instructional courses, providing credits necessary for the commercial pesticide applicators license, start at 1:30 p.m.

For more information, contact: Lori Westrum at The Turf Office at (515) 232-8222 (phone) or (515) 232-8228 (fax).

Florida Chapter #1: The Florida Chapter of the STMA will participate in the Florida Turfgrass Association Southern Turf Conference on January 17. The conference will be held at the Lake Worth Polish American Club in Lake Worth, FL. Educational sessions are scheduled from 8 a.m. to 3:30 p.m. CEUs will be issued.

For more information, contact: John Mascaro (305) 938-7477.

Southern California Chapter: Ballots for the 1997 election of officers and board members have been sent to all chapter members. If you have not yet received your ballot, please contact Chris Bunnell.

For information about the Southern California Chapter, contact: Chris Bunnell at (619) 432-2421.

Minnesota Chapter: The Minnesota Chapter is in the process of planning the event schedule for 1997.

For information, contact: Brian Deyak at (320) 255-7223.

Midwest Chapter: The Midwest Chapter of STMA is putting together the 1997 schedule of events.

For information, call: The Chapter Hotline (847) 439-4727.

Colorado Chapter: For information on the Colorado Chapter and upcoming events, call: 24-Hour CSTMA Chapter Hotline/FAX, (303) 438-9645, and leave a message; or contact: Troy Smith, Denver Broncos, at (303) 649-9000.

STMA Chapters on the Grow

Great Plains STMA: For information on The Great Plains Sports Turf Managers Association or pending events, contact: Mark Schimming of Wichita Baseball Inc. at (316) 292-2907, extension 205.

Arizona: For information on the Sports Turf Managers Association of Arizona or upcoming events, contact: Bill Murphy, City of Scottsdale Parks and Recreation Department, at (602) 994-7954. ❑

Applicator's Log

Sprayer Calibration

By Dr. J.M. Vargas, Jr.

Sprayer calibration is really quite simple, and yet it is one of the most difficult subjects to teach. The difficulty can only be related to the fact that math is involved, although the calculations are quite easy.

Calibrating a sprayer isn't just something that is nice to do — it is a necessity! I know of no other way to accurately apply the proper amount of fungicide.

Mysterious Pest

It reminds me of when I was called to a golf course to look at a disease problem that "no" fungicide was controlling. When I arrived, little turf was left on the four affected greens — mainly because the superintendent had applied four potent fungicides to the greens, at a concentration of 8 ozs. per 1,000 square feet, in a little over a week.

As nearly as I could tell, the disease in question was brown patch. I asked to see the spray schedule record, and sure enough, the fungicides used should have controlled brown patch.

He said, "It only occurred on four greens." I suggested something could be wrong with his sprayer calibration, although it didn't seem likely at the time, since only four greens were affected.

At this, I noticed a strange look on his face, and I said, "You do calibrate your sprayer, don't you?"

He replied, "Of course not, nobody does." He was sure that misapplication couldn't be a problem because two of the affected greens were on the front nine and two of the affected greens were on the back nine.

So I asked him in what order they were sprayed. He told me that he sent his men out to the far end of the course on the front nine, and sprayed the back nine in the same way.

The last two greens on both nines were the ones with the problems, and I suggested that this might be because the sprayer wasn't calibrated, and the people spraying had to hurry over the last two greens on each nine when they discovered that they were running out of liquid in the spray tank.

Needless to say, my suggestion fell on deaf ears. The next year he doubled his fungicide budget, but didn't calibrate his sprayer. His system didn't work any better than it had before, and fortunately, for the sake of the profession, he is no longer in it.

The superintendent who followed him believed in calibration, and for the first time in five years, grass was maintained on those four greens. The membership believed that the new superintendent could walk on water, because he kept grass on those greens all season long. It really wasn't a matter of his walking on water, just calcu-

lating how much of it was coming out of his sprayer.

Application Rate

There are four factors that affect application rate: ground speed, pressure, type or size of nozzles, and the density of liquid. You need to develop a system wherein the first three remain constant and only the last one varies.

Ground Speed. Select a speed that can be used for all areas. If you are walking while treating an area, learn to walk at a comfortable, constant speed. For most people, this is their normal walking speed.

Pressure. Spray with the lowest possible pressure that gives a full pattern to ensure proper overlap between nozzles.

The trouble with people who own high-pressure sprayers is the same as the problem with people who own high-powered cars — since they have all that power they feel a need to use it. Save the higher pressures for spraying tall trees.

The higher the pressure, the smaller the droplet, and the smaller the droplet, the greater the drift problem. If you aren't concerned about your neighbor (and you should be), look at it from a practical viewpoint — what drifts away isn't giving protection where it is needed.

Types of Nozzles. Flat fan nozzles are still the most widely used. You should select one that you can use for all types of spraying.

The nozzles should be changed yearly, because wettable powder formulations are abrasive and will enlarge or misshape the opening.

Density of Liquid. There is obviously very little that can be done to control liquid density. It will vary from one chemical to another and with concentration of fungicide.

The more dense the liquid in the spray tank, the slower it will flow through the nozzles. For precise application, each chemical and rate should be checked individually.

Calibration

The purpose of calibration is to determine how much liquid your sprayer is putting out per 1,000 square feet. The initial calibration usually is done with water. It is assumed that you have already selected the ground speed, the pressure, and the type of nozzles you want.

Fill the tank with water, mark off 1,000 square feet, and determine how much water it takes to cover the area. (This can be determined by refilling the tank with a known quantity of water.)

Another method of determining sprayer output is to collect the liquid from one nozzle while covering the 1,000 square feet and then multiply that volume of liquid by the number of nozzles.

For either method, the process should be repeated three or four times, or until consistent output is obtained.

If the rate is not satisfactory, the pressure can be raised or lowered, the ground speed changed or the nozzles replaced with ones that have a larger or smaller opening.

The above is reprinted with permission from the second edition of Management of Turfgrass Diseases, *pages 151-155, by J.M. Vargas, Jr. (Lewis Publishers, an imprint of CRC Press, Boca Raton, FL, ©1994).* ❑

A sign of dull mower blades, shredded grass blades like this are more susceptible to disease and other stresses. Photo courtesy: Jim Puhalla.

Sports Turf Basics — Beyond IPM

By Jim Puhalla

Integrated Pest Management (IPM) marked a great leap forward from the previous approach that depended heavily on chemicals. But I suggest turf managers go another small step forward and adopt ICM — Integrated Cultural Management.

By this, I'm suggesting that we shift our focus away from the negative aspect of "managing pests" toward the more positive aspect of managing the culture of the turfgrass to keep it healthy. Healthy turf naturally resists pests — thus reducing the temptation to overrely on chemicals.

So what does good ICM consist of?

Stresses

First, ICM gives close attention to the stresses placed on turf. The reason? Pests and other problems usually happen because we've failed to respond to some form of stress. Stresses generally fall into three categories:

- environmental (temperature, water, light, air, etc.),
- mechanical (foot traffic, cleats, mowing, vehicles),
- pests (weeds, insects, disease, nematodes).

The greatest dangers to turf occur

when more than one type of stress is present. For instance, there's the onset of insect infestation during a summer dormancy period. To make matters worse, the dormancy will often mask some insect problems that burst out full-blown when the rains return. If you can keep your turf *actively growing* by seeing that it gets at least one inch of water a week, it will resist stresses much better.

Turfgrasses

Selecting proper turfgrass varieties is one of the best ways to guard against stress. All too often, species are chosen without regard to the sport played on the turf — a mistake in managing the culture. Take football — probably the most turf-destructive sport that doesn't involve horses. Football turf should:

- be dense;
- have a solid thatch layer to cushion falls and keep players out of the mud when it rains;
- recuperate quickly after stresses.

In the South, that usually means a hybrid bermudagrass. In the North, bluegrass has strong recuperative potential. In the transitional zone, it could be either bermudagrass or tall fescue. Properly maintained, these varieties will tend to compete successfully with weeds and resist disease with minimal chemical applications.

Before you install the turfgrass you've selected, be careful to prepare the soil properly. It's not uncommon to see fields with sub-soils so overly compacted that water won't drain. When that happens, the water stays in the topsoil and you have a muddy field.

If the whole field is compacted too much, you get a tight soil layer that makes it difficult for new plants to become properly established. ICM considers the interaction of the turf as a complete system — as a culture — and plans each step of installation and establishment from that perspective.

Fertilization

Unless you conduct a soil test every year, your fertilization program probably amounts to guesswork. With accurate information about what's going on in your soil chemistry, you can achieve a nutrient and a pH balance that will let your grass start thickening. Thick turf tends to crowd out weeds. In fact, I've seen fields that were converted from nicely mowed weed patches into plush, healthy turf just based on more accurate fertilization.

Of course, that doesn't work all the time, but even when you're using a herbicide on your turf, it's equally important to create conditions for the grass to thicken itself. IPM calls for the careful choice and precise application of a herbicide. But if you just manage the weeds (the pest) and don't improve the culture of the turf, they will be back next season. An ICM approach includes steps — such as improving fertility — to thicken the stand of grass.

Aeration

Heavily used fields tend to become overly compacted, probably more than many managers realize — especially in the middle of a football field. The bare spots aren't just caused by mechanical stress from cleats; they're also caused by extreme compaction that makes recuperation nearly impossible. The roots can't get the

Continued on page 26

continued from page 25

oxygen they need. Plus, extreme compaction becomes a physical barrier to root penetration.

The first step in an ICM approach is to realize the effects of all that foot traffic (including a band's marching feet). A good next step is to identify a time for aeration — a time that would best enhance the turfgrass culture.

Since aeration temporarily stresses the turf in order to provide long-term benefits, it's important to aerate while the grass is actively growing. That allows plants to recuperate quickly and strongly.

In the North, you can aerate just about any time in the spring or fall. In the South, it's best to aerate in the late spring or late summer. Transitional zone fields should be aerated according to the type of grass you're using — aerate warm-season varieties according to the southern schedule, cool-season varieties as in the north.

Keeping in mind the mechanical stresses that players create for turf, you'll probably find it best to aerate a couple of weeks before using a field, particularly for football. That allows the turfgrass culture to recover from one stress (aeration) before it has to deal with another (players).

Recommended Mowing Height

Type of Grass	Lowest to Highest	Spring	Summer	Fall	Winter*
Bluegrass	1-1/2 – 3"	1-1/2 – 2"	3"	1-1/2 – 2"	
Ryegrass	1-1/2 – 3"	1-1/2 – 2"	3"	1-1/2 – 2"	
Tall Fescue	1-1/2 – 3"	1-1/2 – 2"	3"	1-1/2 – 3"	
Bermudagrass	3/4 – 2"	3/4 – 1"	3/4" – 1"	1 – 2"	1 – 2"

*Overseeded Bermudagrass

Note: A reel mower should be used for cutting heights less than 2".

Thatch Management

One aspect of sports turf management that cries out for ICM thinking is thatch management. Too much thatch (more that 1/2 inch) can be a haven for insects and disease and can aggravate the stress caused by dry spells. But a thin layer of thatch can help cushion the soil against foot traffic and compaction. On a football field, as mentioned earlier, thatch cushions against falls and helps keep players out of the mud on a wet field.

If your field has one of the aggressive, heavy-thatch species (bermudagrass or bluegrass), it will probably produce too much thatch each growing season. That's especially true if you fertilize and irrigate regularly. Taking core samples twice a year will tell you the thickness of your thatch layer. If it's not more than 1/2-inch thick, don't

automatically dethatch unless you're preparing to overseed a field in the warm-season zone.

Probably the most common dethatching device is the vertical mower. When you're using a vertical mower, remember that it doesn't just rake up thatch; it also severs lateral plant stems. So do the field at least twice in different directions to get the most benefit. As an ICM practitioner, check to see if the turfgrass culture needs fertilization or irrigation afterward to help in recuperation.

If your turf has an especially heavy thatch layer, you may want to consider a biological control treatment, which relies on microorganisms to break up thatch. Some of these treatments use the microbes that are already present in the soil in concentrated numbers to break down the layer.

Mowing

One of the most overlooked practices is effective mowing. At many fields, mowing is conducted by a part-timer with headphones and a glazed expression. But, if you do it right, mowing can help greatly to support the turfgrass culture.

In the warm-season zone, mow up to an inch shorter in the spring and summer than in the fall. In the North, mow an inch higher in the summer than in the spring and fall.

As far as we're concerned, there are four hard-and-fast rules about mowing to support the culture:

1. Always have a sharp blade.
2. Always cut off no more than one-third of the blade each time you mow.
3. With rotary mowers, use the highest possible blade speed.
4. Keep ground speed low.

Some turf managers are starting to take mowing seriously, keeping one mower for use *only* on fields. They're also having the operator take off the headphones so they can explain that mowing is one of the most important parts of the ICM process.

If you have any doubt about the mowing tips above, try them at home first. Mow your front yard the way you normally do, and the back yard our way. You'll be surprised at the difference.

Drainage

Based on renovation work I've been called upon to do, I would say that improving drainage can be the single most important way to improve the turfgrass culture on many fields. Most managers think of sloppy turf only as a hindrance to play. But poor ICM in the area of drainage can lead to all kinds of diseases and other problems.

The complete reconstruction needed to assure good surface drainage may lie beyond the means of many programs. Internal drainage can help, but may be too expensive in its own right.

If a complete system is out of the question, consider a *targeted* internal system to attack problem areas. Or design a complete system that can be installed in *stages*, and let the boosters get to work raising the money for part of the work each season.

As you can see, what I describe as "Integrated Cultural Management" is really just a comprehensive, broad-based program that tries to keep the big picture in mind instead of focusing on specific, narrow problems. A stand of turfgrass is a culture, with many interconnected characteristics. The more of those factors we keep in mind, the better our chances of maintaining a healthy, competitive, pest-free stand of sports turf.

Jim Puhalla is president of Sportscape International Inc. of Boardman, OH, and a coauthor (with Mississippi State University professors Jeff Krans and Mike Goatley) of a forthcoming book, Sports Fields — A Manual for Design, Construction and Maintenance, *copyright 1997, Ann Arbor Press Inc., Chelsea, MI.* ❑

Sample Integrated Cultural Management
Maintenance Schedule
(Cool Season)

Name of Field: Hubbard Stadium Field
Type of Field: Football Game Field
Address: 350 Hall Ave.
Hubbard, Ohio

Condition: good
Type of Grass: blue/rye
Type of Soil: clay/loam
Compaction: yes - middle & bench
Drainage: has internal drainage
Thatch: ½" sides - 0" middle

Soil Test:
Year: 1996 Phosphor: 85
pH: 6.5 Potassium: 350
Notes: knotweed (middle & bench area)
some clover - crabgrass (N.end)
check sprinkler head elevations

Time of Year	Fertilization	Aeration	Topdress	Slit-seed	1/3 Rule Mowing Ht	1" Week Watering	Weed Control
April	18-24-12 ½ lb N 50% SRN	core entire field	for surface leveling	bluegrass middle & bench areas	2"		
May	24-5-11 ¾ lb N 50% SRN	12" solid tine aeration		blue/rye touchup spots	2¼"	light frequent intervals	
June		core 50' each side			2½"	deeper less frequent	
July	16-0-31 ½ lb N 25% SRN				2¾"	deeply	spot treatment
August		slice middle		primed ryegrass middle	2"	deeply	
September	32-5-7 1 lb N 50% SRN				2"	cautiously	
October	20-5-10 ¾ lb N 50% SRN				2"	cautiously	
November	1 lb N after last mowing	core entire field	for surface leveling	now or April	2"		

The new turf field at Arkansas Razorback Stadium has been discussed locally as "the most beautiful field in America." Photo courtesy: University of Arkansas.

Razorbacks Take Command on Enhanced "Natural" Turf

The new turf field at Arkansas Razorback Stadium has been discussed locally as "the most beautiful field in America" *(Arkansas Democrat-Gazette)*. Arkansas replaced its artificial surface with natural turf for the 1995 season and went on to win the Western Division of the Southeastern Conference.

The University of Arkansas (UA) Razorbacks play on two home fields, the War Memorial Municipal Stadium in Little Rock and the Razorback Stadium on the UA main campus in Fayetteville. In 1994, university officials became interested in converting the Razorback Stadium field to a natural playing surface.

Natural turf fields create a much cooler playing surface and, in hot climates, can make a big difference for the athletes. (Artificial turf underlain with asphalt can reach temperatures of 120-plus degrees on hot summer days.) However, natural turf certainly has its own inherent problems with divoting and soil compaction, but fortunately, those effects can be minimized through the use of soil additives.

Searching for Service

Arkansas officials searched for a company to handle the field conversion service. To design the field, they chose Turf Diagnostics & Design, based in Olathe, KS. Five-year-old Turf Diagnostics provides design, testing and maintenance consulting to architects and field managers of golf courses and athletic fields. Chuck Dixon, president of Technical Operations and an agronomist with the company, welcomed the project. One reason is he's a UA alumnus.

Under Dixon's direction, the existing artificial turf was removed to another part of the facility. The underlying asphalt was then excavated, and the field was dug to accommodate necessary trench drainage. A layer of crushed gravel was laid as a sub-base and topped with 10 to 12 inches of a sand and peat mix.

Blending Natural Turf and Plastic

Next a mixture of engineered fibers, Turfgrids, was incorporated into the soil to stabilize the sand base of the football field — an important factor because a stabilized base increases turf durability. Dixon has discovered that the plastic, net-like fiber reinforcement creates a resistance to rutting. The field also becomes divot resistant and more readily "self-healing" when exposed to high traffic and weather conditions.

Dixon already had experience with fiber installations at several other football stadiums. He has been testing fibers for three years and has found they add durability and consistency to playing surfaces.

"Further, creating a natural turf