basically outlined the maintenance program for the sand rootzone and turf based on his knowledge of the best programs for our specific site and weather."

In addition, Patt brought in Chuck Dixon of Turf Diagnostics and Design, Inc., of Olathe, KS, for consultation and on-going soil and tissue analysis. Dr. David York, of Tournament Turf Laboratories in Vallencia, PA, also conducts turf tissue analysis.

"The results of this scientific data are supplied to Heydinger on a monthly basis so he can adjust nutrient levels in accordance with plant needs and current humidity, irrigation and weather conditions," says Patt.

Other participants in Patt's consulting team have come through equally well. He says, "Brandon Koenke, groundskeeper for the Cleveland Indians, is always available to help. Paul Bozek of North Coast Distributing serves as consultant for the Toro irrigation system, responding immediately to post-installation questions and concerns. And the cooperation and flexibility within our own city team has been outstanding. John Reese, recreation supervisor (and Lindsey's immediate supervisor), and Tony Corsi of the Department of Public Works have assisted throughout the reconstruction and follow-up maintenance, supplying equipment and personnel whenever it was needed. Vince Patterozzi of the Cleveland Browns helped out with advice and equipment, too."

Science is at work in the new Munson Field. Patt says, "The field is constructed over 7,000 feet of perforated, corrugated, polyethylene drain pipe installed in trenches in the subgrade spaced on 20-foot centers. The field drains are connected to a perimeter drainage line, which is connected to the appropriate storm drain locations.

Kevan Lindsey, field foreman for the Canton Recreation Department and now head groundskeeper of Munson Stadium, practically lived at the field during the reconstruction.

"The drainage system is covered with a three-inch layer of washed gravel. Above this is a nine-inch, blended, rootzone mix of 95 percent non-calcareous, washed, processed (silica) sand, which meets United States Golf Association (USGA) physical evaluation protocol, and five percent Dakota peat. The turf is a blend of gold tag certified bluegrass sod. The irrigation system consists of 7,100 feet of irrigation pipe connected to a 12-zone, 63-head Toro automatic irrigation system. This system uses a mix of Super 700 and 640 series rotary sprinkler heads.

"The infield skinned area is a local clay base topped with Tennessee Morie clay mix and a blend of Beam Clay red brick dust and Soilmaster. The pitching mounds and home plate areas are maintained with Beam Clay red mound mix. The warning track is crushed red brick supplied by the locally based Belden Brick Company."

The infield takes shape atop a new drainage system.

The Payoff

Did all this scientific analysis pay off? As Lindsey says, "Surface drainage on the new field is as natural as water going down the bathtub drain. With the constant input of scientific information, the turf has top growing conditions, adjusted to meet changing needs. When you give grass what it needs, when it needs it, it pretty much takes care of itself."

This isn't to say a lot of tender, loving care won't help. Patt says, "Kevan practically lived at the field during the reconstruction and that first season. I think he knew every blade of grass personally. He was on the alert for any change in growth pattern, coloration, or apparent vigor. It gave us an extremely fast action-reaction system."

While the infield was being sodded, the nine-inch-deep rootzone for the outfield was prepared.

Play started the first of April in 1995, and the turf was in great shape. There were some initial problems with the clay areas. Winter weather had closed in soon after the reconstruction was completed, and stayed around for the duration. Lindsey says, "The clay area at home plate and the mound drew a lot more moisture than we'd anticipated. The sand retained a great deal of moisture during the sudden temperature drop, and this moisture moved up and under the tarped clay surfaces. Certain areas of the base path also drew moisture and entered the season wetter — and thus softer — than we wanted. We ended up replacing the clay mix in some areas, reworking it in others, to achieve the moisture content and texture we wanted."

With 30 inches of snow by the end of January 1996, Lindsey prepared for some wet clay entering spring. He says, "Weather permitting, we'll remove the tarps earlier in the season to allow more time for air drying before play begins."

The second challenge for the first-year field could have been even greater. Extended periods of temperatures in the 90 and 100 degree range combined with extremely high humidity aren't the norm for Cleveland — or cool-season turf. Fungus problems devastated area grasses. But Lindsey's constant observation (the art), combined with continual input from the consulting team (the science), resulted in a full season of good-looking, highly playable turf.

No Shortcuts

Management practices also contributed to success. Munson Field has a

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Pro Diamond

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$90,000 operating budget. Daily maintenance equipment includes a ride-on reel mower, a power field-rake and a utility vehicle, along with standard hand tools.

Lindsey has a five-person crew, all currently in college. One crew member had recreation department experience; one had golf course experience. The rest of the training Lindsey supplied himself. "I started each person on a specific job, covering the basics and proper techniques and giving them the time to gain proficiency at that task. One person concentrated on mowing, another on mound preparation, and so forth. As their experience levels grew, so did their job responsibilities. They're a hard-working crew and developed into a real good team," Lindsey says.

Patt challenged Lindsey to maintain the field without some of the traditional "shortcuts," like cutouts for coaches boxes or fungo circles. These areas are painted on the turf at Munson Stadium, just as they are at Jacobs Field.

Lindsey says, "We used a two-prong, step-on aerator to relieve compaction in the coaches boxes and fungo circles. We kept applying small amounts of seed and occasionally topdressed lightly with sand. We mixed TurfGrids® into the sand profile around home plate and the pitchers mound when the field was installed. Toward the end of the season, we did show some wear at the batting cages and did cut out a wider swath of skinned area at first and third base, where the players round the corners, to alleviate wear there, but overall the turf held up well. We alternate mowing directions at every mowing and occasionally do delay mowing until later in the day following heavy rains. But the new field's growing conditions are so good, we've had to make few maintenance adjustments."

Lindsey also maintains a small "sod farm" in a 30-foot by three-foot section of the bullpen. He says, "With the same turf varieties growing on our rootzone mix under the same maintenance practices,I have about 20 rolls of 'insurance' on hand, if I need it."

Lindsey also works closely with the team's coaching and management staff to fine-tune field maintenance to produce the conditions they prefer. And he confers with the ultimate critics themselves. "I talk to the players at every level, asking what they like and don't like," says Lindsey. "Every time I'm on the field I'm looking for what we can do to make it better."

Patt says, "There aren't any tricks to this. Science and the numbers don't lie. When the proper technical data is given to a top team of knowledgeable people, there's no trial and error to problem solving. Then you provide that scientific support to a hands-on sports turf manager with the 'eye' to see what's happening on the field and the knowledge, dedication and commitment to do what it takes to apply those scientific solutions precisely as needed. It saves time, money and frustration. The better the team, the better the results." ❑

Bob Tracinski is manager of public relations for the John Deere Company in Raleigh, NC, and public relations co-chair for the national Sports Turf Managers Association.

PRODUCT SHOWCASE

Chandler Arizona Parks Department

Chandler, Arizona

Chandler Arizona has selected Primavera bermudagrass for all fifteen of the new soccer fields that have been seeded in the last eighteen months. In addition, they are using Primavera on all the city parks and grounds.

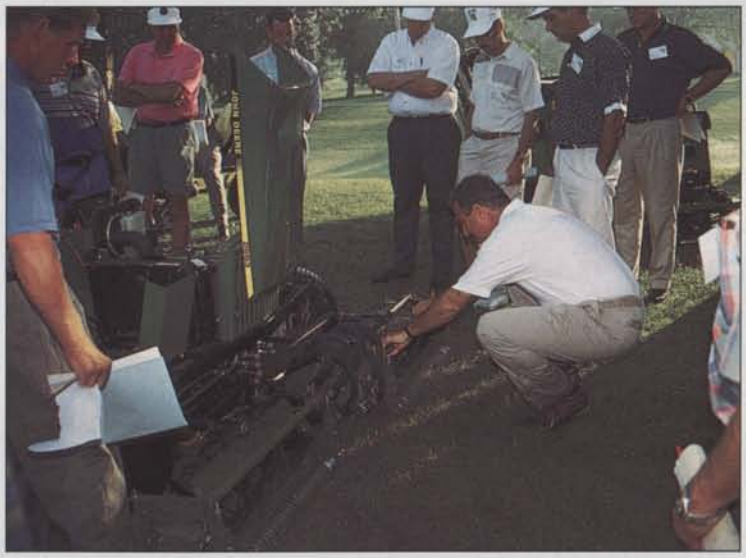
According to Kris Kirsher, maintenance coordinator, they have used common bermudagrass before but had problems with allergic reactions among the players. Then they tried Mid-iron bermudagrass but is was very susceptible to bermudagrass scale. The third variety they tested was Primavera. Kris was really impressed with its quick germination and establishment. It stayed greener longer in the fall and greened-up earlier in the spring than any of the other seeded types they tested. Primavera also was resistant to bermudagrass scale, so their problems were solved.

Kris and his crew of four were able to convert old cattle corrals, to excellent quality soccer fields. The San Tan Soccer Association plays on the fields nine months out of the year and with the use by other groups, there are soccer games almost every day of the week throughout the entire season. The quality of the playing surface is excellent throughout the year. The number of injuries and loss of players have been greatly reduced with the dense turf that they are able to produce with Primavera. It has been stated by numerous authorities that Chandler has the best soccer fields in the Phoenix area.

The work done by Kris and his crew is impressive, especially when one realizes that it was done on a minimum budget.

"Primavera is a high quality, lower cost alternative to the standard turf varieties sold only in sod or stolon forms." *Kris Kirsher, Maintenance Coordinator*

Mower Maintenance for Fewer Problems



Accessibility and ease of service increase mower longevity. It's just human nature -- the easier it is to service a machine, the more likely it is that the service will be done.

By Eli Luster

Mowing equipment includes a broad category of machines, and each unit has the probability of unscheduled service needs (breakdowns) due to lack of maintenance,operator error, or damaging operating conditions.

While the service technician can't control every aspect of mower use, wise management of mower maintenance increases the productivity and longevity of the machine, and saves time and money.

Service begins with the purchase. Determine the specific functions the machine will be used for, under what conditions, what its hourly usage will be daily, weekly and monthly, and how long it needs to last. Choose the unit with the features you need that has a proven history of durability and fits within your budget. Consider ease of operation, ease of service and accessibility of service points. Factor in the expertise of your servicing dealer or distributor.

A basic plan of preventive maintenance is provided for each machine in the operator's manual. The specific procedures and service intervals listed in the manual have been developed by a team of product engineers based on intensive testing and actual, in-the-field, operation. The guidelines are designed to maintain optimum performance with minimal downtime.

Welcome operator input. The person operating a machine day after day can alert the service technician to an unusual sound, a change in operating efficiency.

Fuel and Fluids

Avoid maintenance problems by assuring that the correct fuel is used with each mowing unit. Where multiple machines have varying fuel requirements, dedicate a small can of the correct fuel to a specific mower. Place a number or identifying mark on both the can and the mowing unit with paint or a permanent marker.

Use the same system to identify other fluids needed for each machine.

Store fuel in quantities that will be turned over within seasonal conditions. Winter and summer blends of gasoline have differing "flash off" points to help equipment start and operate properly. The #2 diesel fuel, standard for summer operation, will be blended with #1 diesel fuel as temperatures cool, and in northern climates, a change to straight #1 diesel fuel will be necessary in the winter. In warm, humid, climates an algaecide or bacteriacide should be added to stored diesel fuel. Otherwise, a white, slimy or dark black substance may develop that will plug filters and make the fuel unusable.

Store fuel in proper containers. Even sealed containers can "breathe" with fluctuating day and night temperatures, pulling in moisture in the humid air. Water in fuel can plug filters, cause corrosion, hamper machine starting or even seize up an engine.

Follow EPA rules precisely, both in storing fuels and other preventive maintenance supplies, and in disposal of such waste as oil and antifreeze.

Sharpness

The most important single factor in quality of cut is sharpness. Regional and site conditions determine sharpening frequency. Sandy soils "etch" cutting units, taking the edge off, and thus requiring more frequent sharpening. Other turf maintenance procedures affect mowing conditions. If turf is topdressed with sand, have operators use an older mower for that first cut afterwards to avoid running sand particles through the cutting surface of precision equipment.

Rotary Mowers

Rotary mower blades need periodic sharpening to maintain a proper edge. Blades will need to be balanced and properly re-installed on the machine. Keep a set of sharpened blades ready for each mowing unit so replacements can be made quickly. Sharpen the blades removed as soon as the workload permits.

With rotary mowers, keep a front-to-back deck adjustment so the front of the deck is one-eighth to one-quarter inch lower than the rear. This prevents "drag" by allowing the sharpened, cutting edge of the blade or blades to contact the grass, rather than the broader, unsharpened area. Level the deck from side to side so that the grass cut is the same height all across the swath.

Maintain the height of cut segments of the mower, adjusting caster wheels and anti-scalp rollers as necessary. The

accuracy of their positioning also influences quality of cut.

Clean the under-deck of rotary mowers frequently to remove the buildup of clumped grass. Under-deck "crud" hampers cut quality by altering the airflow dynamics which "pull" the grass blades into an upright position where they can be cut cleanly by the rotating mower blade or blades.

An anti-stick compound sprayed on the under-deck may help to limit under-deck debris build-up, but applications must be repeated frequently. The compound will "wear off" unevenly in response to the varying force and frequency of clipping and debris contact.

Reel Mowers

Reel mowers deliver a precision cut. Follow manufacturer recommendations to retain sharpness and precision.

Allow a clearance of .001 to .002 of an inch between the reel and bedknife. If the reel contacts the bedknife it will produce heat, dull the edge of the reel, and eventually destroy the mower.

Keep the reel sharp with regular backlapping. Use periodic grinding to restore the relief angle and restore the reel to roundness.

Keep the reels and bedknife parallel to the ground; the front and rear rollers parallel to the bedknife. The height of cut adjustment comes by adjusting the front and rear rollers.

The front of the bedknife could be tipped down slightly (one-sixteenth of an inch or less), but never tipped up. A relief angle on the bedknife, with the bedknife positioned parallel to the ground or tipped down as mentioned above, delivers the desired cut. The upper edge of the bedknife contacts the top portion of the grass blades, moving them into position to be cut cleanly by the mowing reel. If the front of the bedknife is tipped up, the heel of the bedknife contacts the lower segment of the grass blade, bending the grass over.

The clip ratio of the turf cut is determined by the number of blades on the reel, reel speed, and the speed at which the reel moves across the turf. With ride-on mowing units, varying the ground speed to compensate for such conditions as wet grass will improve the quality of cut. Too fast a ground speed will result in the wavy, uneven, height of cut pattern called marcelling. Thus the operator again becomes an important element in machine performance and longevity.

Compressed air does a better job of cleaning reels than high pressure washers because wet grass "clumps" more than dry grass. If mowers are washed down, grease all the zerks following the wash down. The grease flushes out any water that has accumulated and may provide a barrier to prevent water from entering at the next wash down.

Plan Ahead

Consider the trade-in value of the equipment when planning the preventive maintenance program. Accurate record keeping of when service was performed and what parts were used provides an overall picture of the machine's condition. Little things, like regular touchups of paint, keep the machine looking good. Many facilities are in the market for quality used equipment. You'll help them, and your budget too.

Don't forget operator pride. A machine that looks good and operates effectively becomes "my" machine, deserving proper care. Machines that look like junk are treated as such.

There are differences between OEM and will-fit parts. Even when two parts look the same, production quality or specific additives will affect quality. OEM parts fit the exact specifications of the manufacturer. Compare the costs of parts to the risks involved if they fit improperly or fail.

Well-managed service records reveal what parts need to be kept in stock in what quantities for preventive maintenance on each machine. Stock such high-wear items as filters, belts, rotary blades and filters. Start new machines with a service kit of parts for the first, or first two, service intervals.

Anticipate needs. Develop a system to track the next service interval. Check the operator's manual and order necessary parts in advance of that period.

Safety

Consider operator training both a preventive maintenance and a safety factor.

Before releasing any mowing equipment for use, make sure all safety and operator presence systems are in place and operating properly.

Preventive maintenance translates to increased performance and longevity. ❑

Playability Versus Liability

Surrounded by attendees of the California Sports Turf Institute at Santa Anita Park, Dr. James Beard explains the effectiveness of Clegg Hammer measurements. Photos courtesy: Stephen Guise.

By Stephen H. Guise

It's third down; the ball is snapped. As the quarterback scrambles, he spots a breakdown in his offensive line. Just as the quarterback releases the ball, a defensive lineman drills him into the turf. His head bounces off the turf like a superball on your driveway. The crowd is hushed as he lies motionless, surrounded by the training staff. The dreaded cart appears. Before the game ends, the local hospital reports that the quarterback "just" suffered a concussion. He'll be back in the game next week.

We saw this too many times this year: from simple abrasions to season-ending injuries; from Jeff George of the Atlanta Falcons to Gil Haskell, assistant coach of the Green Bay Packers, who suffered a fractured skull when two players slammed into him during a playoff game, driving his head into the hard artificial turf.

It's no wonder that organizations such as the NFL Players Association (NFLPA) are taking a stand against field surfaces that they believe are shortening the professional careers of their members.

The NFLPA has launched a crusade to do away with artificial turf in the NFL. Though Troy Squires, vice president of Southwest Recreation Industries, Inc., manufacturer of AstroTurf, was quoted in a recent article as stating that his company was getting a bum rap, many players think otherwise.

When you listen to John Kerr and Clark Gaines of NFLPA, you begin to understand their players' concerns. Darrell Green, a cornerback for the Washington Redskins, had this to say about playing on artificial turf, "The burns literally take your skin off....Half of your arm or the sides of your calves are skinless." The Redskins' Brian Mitchell speaks of the after-effects of playing on artificial turf – the sprained ankles and aching knees and hips. The Bengals' Ki-Jana Carter missed his rookie year after tearing the anterior cruciate ligament in his left knee while playing on an artificial surface.

There is no time in the history of sports that the construction and maintenance of playing surfaces has been so closely scrutinized. Ralph Nader, the consumer advocate, is even involved! Add to this today's extremely active legal system and all the lawsuits flying around. Field playability and the liability factor are linked in a delicate – and costly – balancing act.

Are artificial surfaces the entire reason for increased player injuries at all levels of play?

In all fairness, we must realize that artificial turf is not the whole problem. Poor maintenance and construction of natural turf fields also are to blame. Three NFL teams – the Chicago Bears, New England Patriots, and the Kansas City Chiefs – have pulled their rugs and installed natural turf with their own set of problems.

Gauging Field Playability

The playability of a field is a measure of how safe that field is and at what level of play (field consistency) that field will perform. Terms often associated with field playability are hardness and traction. A field is either too hard or too soft. Traction is either lacking or too great.

The field's hardness has a direct relationship to the speed of an athlete running on its surface. Hardness is also related to the degree of potential injury the athlete will sustain if he or she falls or is delivered to that turf, or if the turf stops a player's forward motion without communicating it first to his or her body.

Strong, fast turf does not necessarily have to be a hard surface. During my tenure at Santa Anita Park in California, thoroughbred horses broke track records on a turf course that was firm, without being hard. There is a difference. Firm turf is a product of sound agronomic

principles, developing deep and dense root systems supporting a thick, natural carpet of turfgrass biomass at the surface.

Soils scientists have faced a dilemma in stabilizing sand fields without creating hard, impermeable rootzones. As various organic or synthetic fiber materials were added to a sand for stability, the valuable pore space necessary for oxygen and water infiltration was filled, resulting in compaction through increased bulk densities. This hard soil supported only limited, shallow-rooted turf, and playability declined. Dr. James Beard and Sam Sifers of Texas A & M University spent numerous years researching this situation and seeking ways to develop naturally tough turf. Their work with a three dimensional system of sand/mesh allowed them to achieve stability and agronomic benefits, with a surface they found could be firm without being hard. (Those interested in further information on the research of Dr. Beard and Sam Sifers, including a copy of "Enhancing Participant Safety in Natural Turfgrass Surfaces Including Use of Interlocking Mesh Element Matrices," presented at the November 1994 American Society of Testing and Materials [ASTM] Symposium on Safety in Football, may contact Stephen Guise.)

Don Waddington of Penn State stands with the Penn Foot for field traction testing.

The Clegg Impact Soil Tester (also called the Clegg Impact Hammer) had been used for years to measure the hardness or compaction of road bases. This instrument is now accepted within the scientific community as a measure of field hardness and is used to relate this field hardness to the safety of the athlete. Hardness standards for both natural and artificial turf fields have been researched by the ASTM, and the Clegg Hammer has been the instrument of choice due to its lightweight structure and measurement accuracy.

How hard is too hard? Many have studied this issue, including not only Dr. Beard and his associates but also the Sports Turf Research Institute (STRI) in Bingley, England. STRI's research focused on soccer fields in Europe while Dr. Beard's findings were based on three years of research at Santa Anita Park. Despite the obvious differences in the "athletes," the hardness criteria are similar in the two sports.

Hardness is only half of the problem associated with poor playability of sports fields; traction is the other half.

Soil scientists have accelerated their studies into the manipulation of sand-particle-size distributions to increase

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Playability

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the playability of the sand rootzone playing fields. I caution you to leave this technical work up to approved soil labs and soil scientists. I have seen firsthand the failure of sports fields and turf courses when the mix of sand and soils has been done incorrectly. The results can be disastrous – and costly.

Penn State's elite soils program has published guidelines that clearly state the basic soil physics for properly adding loamy soil to sand fields to increase the fields' stability and agronomic effectiveness. The key when adding loamy soils is to blend them with medium-to-coarse size sands. It's when medium-to-fine size sands are blended with finer silts and clays that the results are more representative of concrete than the basis for a sports field. (Those interested in further information on this subject may wish to contact Don Waddington or Andy McNitt at Penn State for a copy of the research.)

The Penn State turf research team also developed for sports fields a traction testing apparatus commonly known as the Penn Foot Traction Machine (or simply as the Penn Foot).

Santa Anita's track is firm without being hard. Firm turf results from developing deep, dense root systems capable of supporting a thick, natural carpet of turfgrass biomass at the surface.

Tests with the Clegg Hammer and the Penn Foot provide a comparative means of gauging a field's playability in terms of hardness and traction.

Demand Proof!

Many new products and companies have entered the arena of field design and construction, and some old systems have been reworked. One must look clearly at hard scientific research and data to evaluate their effectiveness. Too many fields are being constructed and failing due to a company not doing its homework and attempting its research on playing fields at the expense of the end user, the athlete. Research followed by field trials should be standard protocol before any product is used on sports fields.

Another problem is inappropriate or shoddy construction performed by inexperienced landscape contractors.

Demand experience of those who are doing the critical stage of building your fields.

Limiting Liability

Those of you who attended the Sports Turf Managers Association's 7th Annual Conference and Exhibition in Anaheim, CA, this past January had the opportunity

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